PAINT and VARNISH Production

THE TECHNICAL MAGAZINE FOR MANUFACTURERS OF PAINT, VARNISH, LACQUER AND OTHER SYNTHETIC FINISHE

ECIAL FEATURE:
ALKYDS IN
TRANSITION
See page 23

MARCH
1959

Newport

NPT CONCENTRATE

Lowers End Costs

OF EMULSION PAINTS BASED ON VARIOUS LATICES

NPT CONCENTRATE is a product for use in latex paints based on butadiene-styrene, polyvinyl acetate, or acrylic latices.

When used in polyvinyl acetate and acrylic latex paints, Newport NPT CONCENTRATE improves the adhesion of latex paints over already painted surfaces.

It is a 100% solids content material, containing no solvent. It does contain a balanced combination of driers, eliminating the necessity of adding driers for it in any of the latex paints.

IMPROVES ADHESION IN POLYVINYL ACETATE AND ACRYLIC EMULSION EXTERIOR PAINTS

NEWPORT NPT CONCENTRATE improves the adhesion of these latex paints and should be instrumental in effecting a worthwhile reduction in raw material costs.

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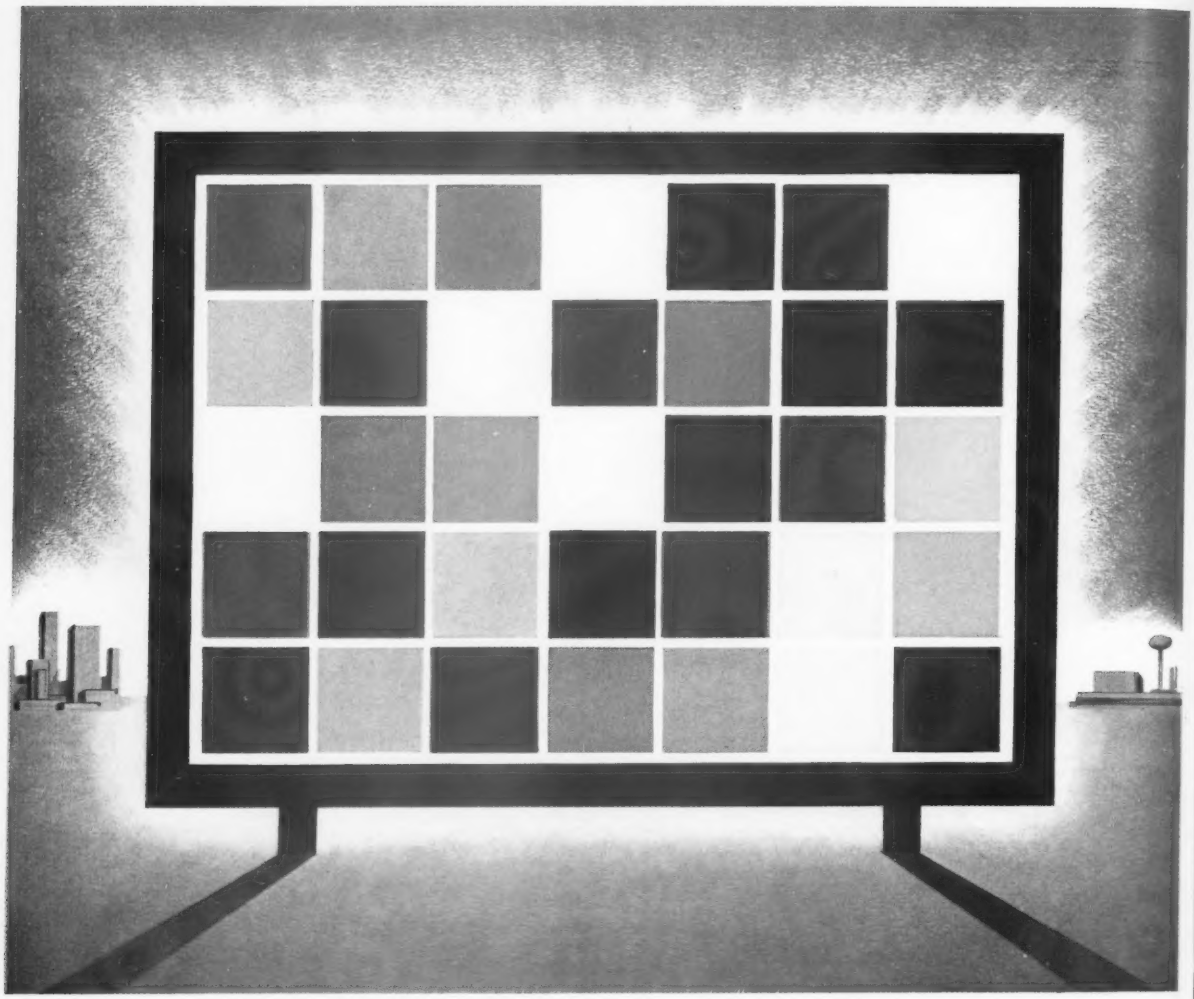

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Shell Chemical has maintained for many years an active program of practical and theoretical research in oxygenated solvents and Epon® resins for surface coatings.

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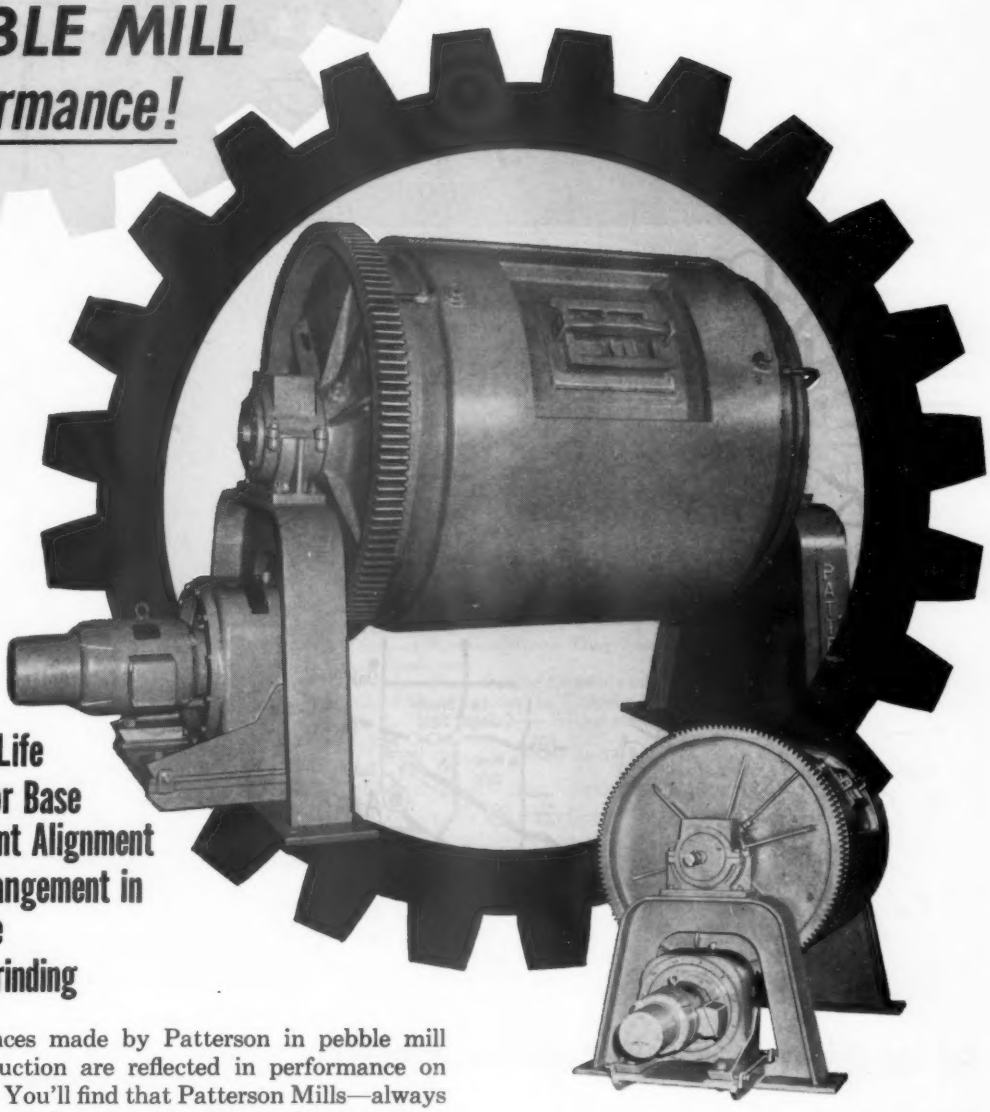

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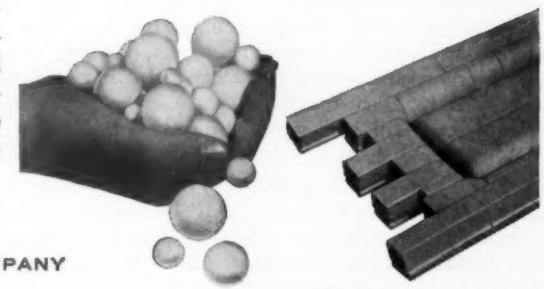

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NEXT ISSUE

An interesting article dealing with the alkyd composition graph and its application for formulating alkyd resins having specific performance properties is scheduled for our April issue.

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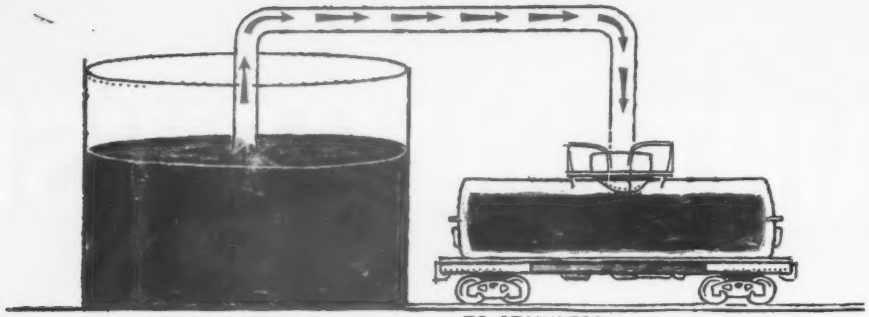

FROM OUR STILL RECEIVER . . .
Plastics and Coal Chemicals Division has perfected methods of storage and transfer for molten phthalic anhydride which assure color stability and freedom from contamination.

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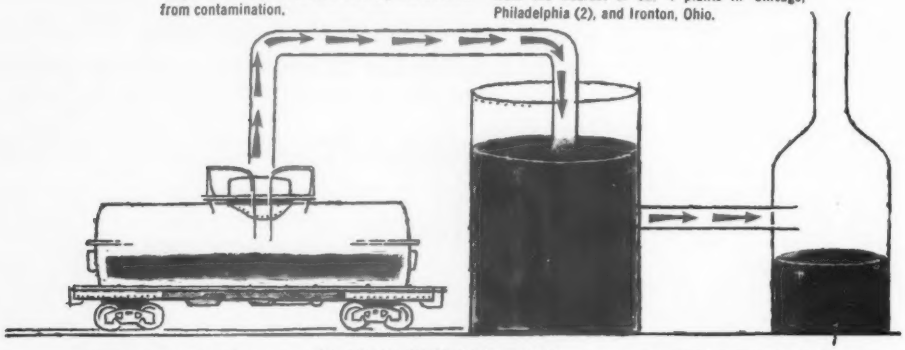
For short hauls of 100 miles or less, tank trucks are recommended. Molten phthalic will be shipped from the nearest of our 4 plants in Chicago, Philadelphia (2), and Ironton, Ohio.



FROM STAINLESS TANK CAR OR TRUCK
Tank cars may be unloaded from the top, by inert gas pressure, or from the bottom, by gravity flow.

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An 18-8 stainless steel insures against discoloration. Tank should be well insulated, with internal heating coils and temperature controls. Molten phthalic is blanketed with inert gas.

TO END PROCESS
Molten phthalic is readily pumped to process by centrifugal pump. Its high temperature speeds processing, and increases capacity of existing equipment.

The Care and Handling of Phthalic Anhydride

Large users of Phthalic Anhydride can realize substantial savings by converting to molten phthalic. For smaller users, Plastics and Coal Chemicals Division ships the flake form in unit loads designed for peak efficiency at the receiving end.

As your business grows, so do your raw material tonnages. As this happens, you may eventually have to ask yourself, "Will it pay me to switch to molten phthalic?"

We have helped many customers answer this question. It's a matter of carefully estimating the cost savings you may expect . . . and comparing these savings with your anticipated investment in handling equipment for molten phthalic.

Shipped in molten form, Phthalic Anhydride will cost you less per pound than flake. The saving is ½¢ per pound.

You must also consider the labor savings—no bags to unload, transport, empty or dispose of. And, because you introduce the phthalic at 150°C, you can save on process heat requirements. Other benefits that help swing the balance are less easy to measure in dollars and cents:

- Increased productive capacity resulting from shorter reaction cycles with hot molten phthalic
- Release of precious indoor storage space
- Elimination of waste and dust
- Reduction of contamination possibilities (molten phthalic is handled in a closed system)

Perhaps it's time you discussed conversion—or some other modification in your handling of Phthalic Anhydride, be it molten or flake. Call our representative or write us direct and we'll get in touch with you posthaste.

And in the Flake Form . . .

Plastics and Coal Chemicals Division ships a variety of unity load arrangements to speed unloading at the receiving end. Before shipment, bags are "kneaded" between giant rollers to give them the firmness and flatness that make ideal unit loads.

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EDITORIAL COMMENT

Microbes and Paint

WE were intrigued by a recent report in *The Wall Street Journal* on how microbes are performing important jobs in agriculture and various industrial applications today. Of particular interest was a special breed of microbes which are helping to find, recover, and refine oil; mine and process metal-ores; extract new chemicals from coal; purify polluted air; and also provide oxygen, food and water for future space travelers.

Bacteria research is being pushed by firms as microbes are capable of doing some jobs that cannot be done by other known methods. Also, bacteria hold promise in cutting cost of complex chemical processes which require high temperatures, pressures, etc.

The range of possibilities for using living organisms in synthesizing paint raw materials have been envisaged by biochemists. For example, enzymes have been studied as catalysts for producing resinous material. Enzymes are specialized proteins each capable of specifically catalyzing one or a few chemical steps. In this connection, there has been some interest in the biosynthesis of fatty acids. From these studies, it appears that carbohydrates are converted, through a long chain of enzyme reactions, into acetic acid which then combines with a vitamin derivative; the vitamin complex combines with other acetic acid containing compounds to build up the long molecules of fatty acids. The fatty acids thus produced are saturated, but by some remarkable means, the living organism then proceeds to extract hydrogen atoms from various positions to produce the unsaturated fats. Unfortunately little is known how the enzymes accomplish the desaturation process. However, it is known that different species of living things have different desaturating enzymes, and that this difference is a major factor in determining whether the double-bonds are conjugated or not. Even the production of resins and shellac-like materials via micro-organism has been postulated.

Obviously, the commercial feasibility of such methods will depend on the degree to which research on the problem is prosecuted. Outstanding successes have been gained in the field of antibiotics and mold synthesis, where various types of organisms have been examined and their nutrient requirements for snythesis of the desired products have been carefully determined.

While synthesizing film formers biochemically may seem visionary, one doesn't have to look very far to find how other industries are profiting by using microbes in their chemical processes.

Alkyds in Transition

MORE than 400 members of the paint and allied industries attended the alkyd symposium which was featured at the recent annual meeting of Glycerine Producers' Association in New York.

In the interest of bringing you up-to-date on the technological status of alkyd resins for coatings, PAINT and VARNISH PRODUCTION is pleased to present in this issue the complete text of the seven papers presented at this symposium.

Alkyds are still the major vehicle for the paint industry as they constitute almost half of the more than 800 million pounds of resin used in coatings today. Reasons for their popularity in the paint field were aptly stated by Dr. Herman J. Lanson who opened the symposium with these comments:

"No resin-forming reaction lends itself to greater useful variation and modification than the formation of alkyd resins. Although alkyd resins have been used in protective coatings for over twenty-five years, their consumption continues to increase, and even today they rank as the most important synthetic coating resin and constitute about half of all the resins used in organic coatings. The amazing versatility and usefulness of alkyd resins is due not only to the wide variation in properties that can be obtained in the alkyd-forming reaction per se, but also as a result of the ability of alkyds to improve the performance properties of other resins."

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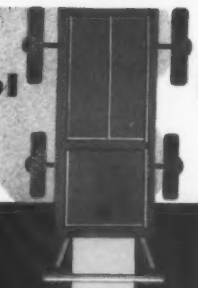

How to make traffic paint tougher

Rugged traffic paints that withstand constant heavy wear are one of the many coating vehicles made better at lower cost with Velsicol Hydrocarbon Resins. Among the improved physical characteristics that Velsicol Resins make possible are greater hardness, adherence, and resistance to impact. Technical Bulletin 203 tells why, and your Velsicol representative can show you how. Get them both in front of you soon!

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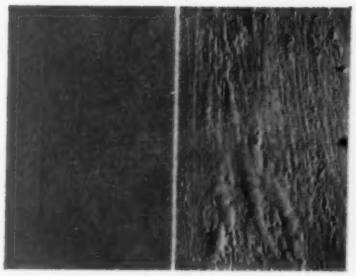
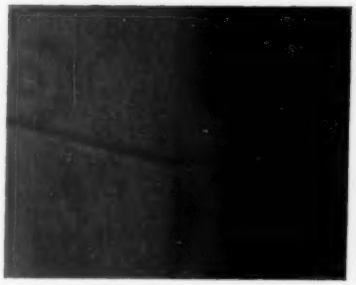
FOR EXTERIORS

... masonry buildings like this are easily and quickly coated with paints based on BAKELITE Brand Vinyl Latex WC-130. In addition to being easy to apply, coatings made with this material have been extensively tested for their ability to withstand weathering, sunlight, and fading. In the new-home construction field as well as the equally important maintenance market for older structures, there exists a good business potential for masonry paints that can offer the advantages of those formulated with WC-130.

Right over sealing tapes, paints based on WC-130 give today's drywall construction a smooth, clean coat. With ordinary paints, borax in tapes can be a handicap — forming brush-clogging particles that spread and spoil the finish. Made with WC-130, paints spread flawlessly and effortlessly, producing a perfect surface in record time.



Sandblasted by a hurricane, with winds up to 140 mph., this exterior paint based on WC-130 shows no damage, even though it was applied only 24 hours before the storm struck! No repainting or touching up was needed.



Sell the paint that's *better for BOTH*

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Now—for exterior and interior use alike—you can formulate vinyl latex paints with the remarkable qualities of BAKELITE Brand Vinyl WC-130.

They'll be notable for their one-coat hiding power, fast drying, freedom from odor, and ease of application. Their high pigment volume content and resistance to foaming will be outstanding. On exterior masonry, they'll demonstrate excellent weatherability, color retention, and resistance to checking, peeling, and blistering. All these are selling points that can open the door to more business.

WC-130 is the special vinyl latex formula developed by Union Carbide Plastics Company, whose experience in vinyls is unsurpassed. Make sure your vinyl latex coatings are based on the best materials for production and performance. Mail the coupon today.

FOR INTERIORS

... a room like this 90 x 70-ft. ballroom in New York's Barbizon-Plaza Hotel can be painted with coatings based on BAKELITE Brand Vinyl WC-130 and be used in a few hours. Superb one-coat hiding power, quick drying, and absence of odor are among the advantages of these coatings that make them popular for public buildings as well as homes. Their durability and color retention have been determined by rugged laboratory testing as well as field experience. The formulator here was A. C. Horn Div. — Sun Chemical Co., Long Island City, N. Y.

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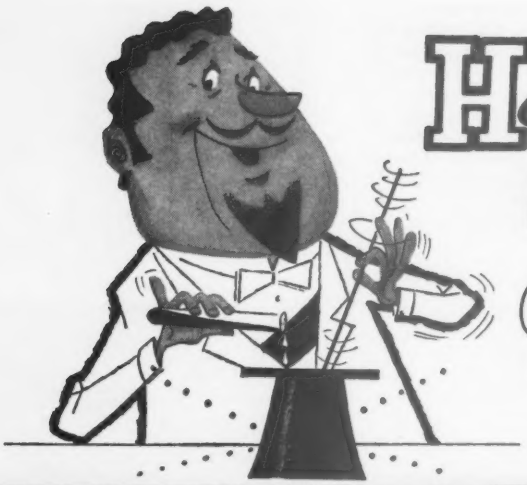
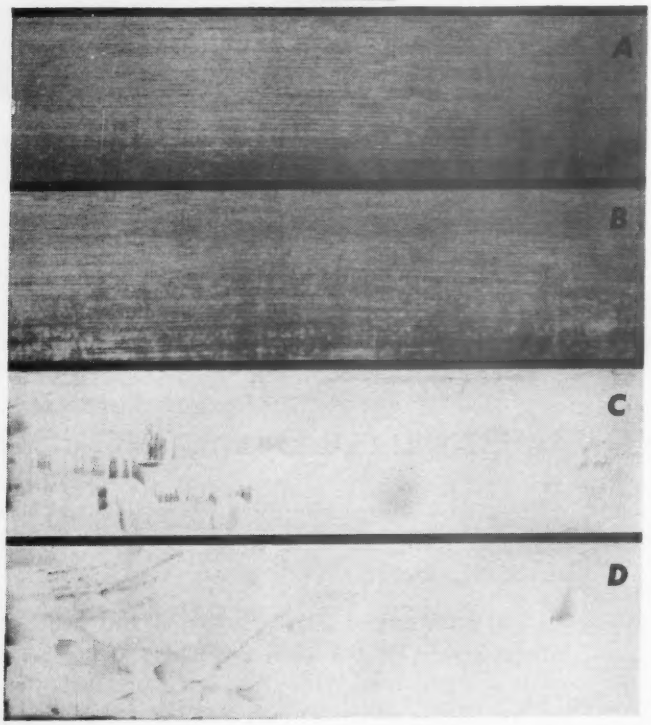


How to make mildew problems vanish!

(Use the right amount of Eagle-Picher Zinc Oxide in your house paint formulations!)



Here's the proof!

You don't need a microscope to see the *difference* in this set of paint panels. Yet, each panel was painted with house paint formulated in linseed oil vehicle at *constant pigment concentration.* Each was exposed, side by side, for fifteen months in an area of heavy mildew growth. Then why the big difference?

Simply this:

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Yes, the right amount of zinc oxide in paint formulations is an economical, highly effective and permanent *mildew inhibitor.* So, depend on Eagle-Picher Zinc Oxide for durability, color-retention, detergent action and low-cost anti-mildew properties!

Are you using enough zinc oxide in your house paint?

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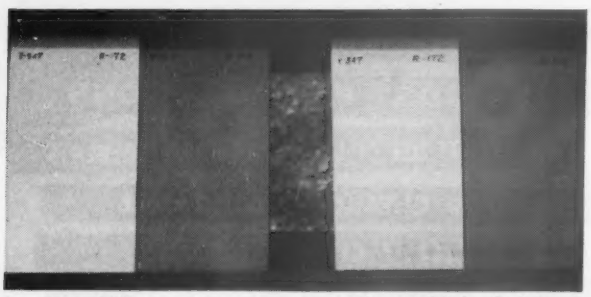
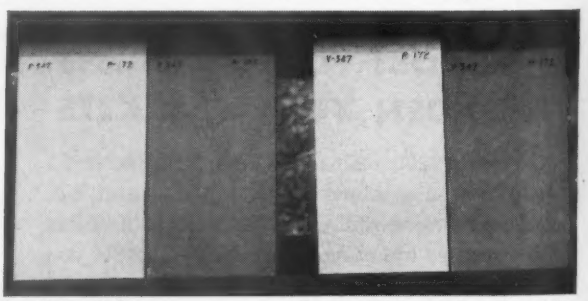
NEW DOW ACRYLIC LATEX SHOWS GREAT PROMISE FOR EXTERIOR WOOD HOUSE PAINTS

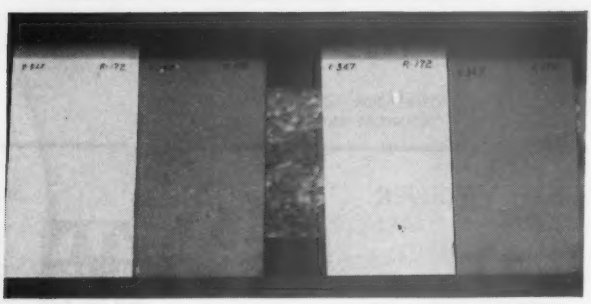
Ever aware of the need for new paint materials which meet demands of an expanding market, Dow has developed a new acrylic latex—Dow Latex 2647—for use as a binder for finishes for exterior wood surfaces. The test panels illustrated below show how paint formulated with 2647 compares with other latex paint binders. Exposure tests indicate that it is possible to formulate with 2647 an exterior wood finish which will possess all the sales features of interior latex paint . . . easy applicability, quick drying, easy touch-up, and the ability to wash equipment using only soap and water. Much experimental work has already been done at Dow and data concerning these tests is available to manufacturers. Samples of 2647 are available for experimental purposes. Now is the time to begin developing your own formulation—be ready to take advantage of this new market for latex paint.



Dow Latex 2647 — Commercial Acrylic Latex A



Dow Latex 2647 — Commercial Styrene-Butadiene Latex



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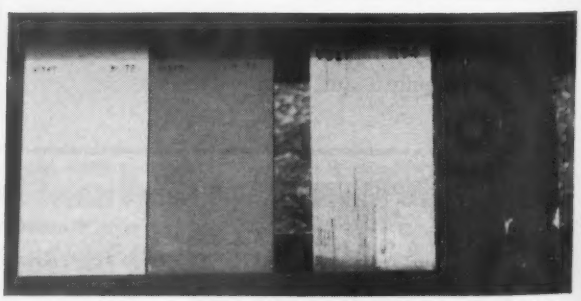

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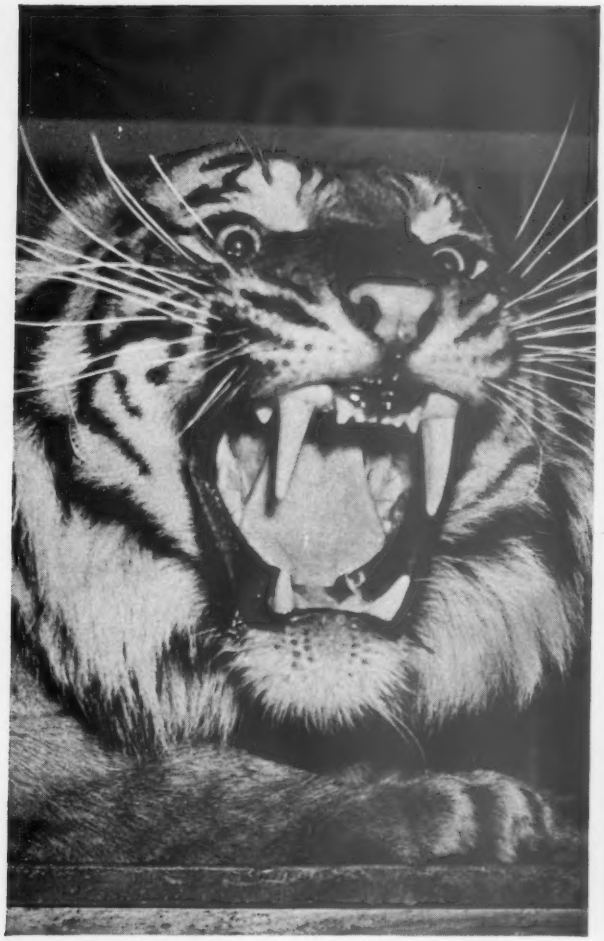

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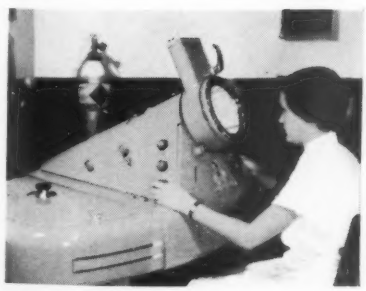

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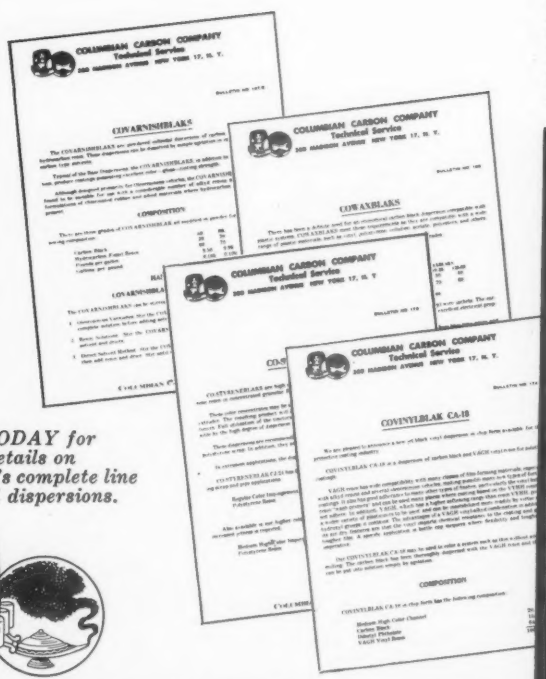

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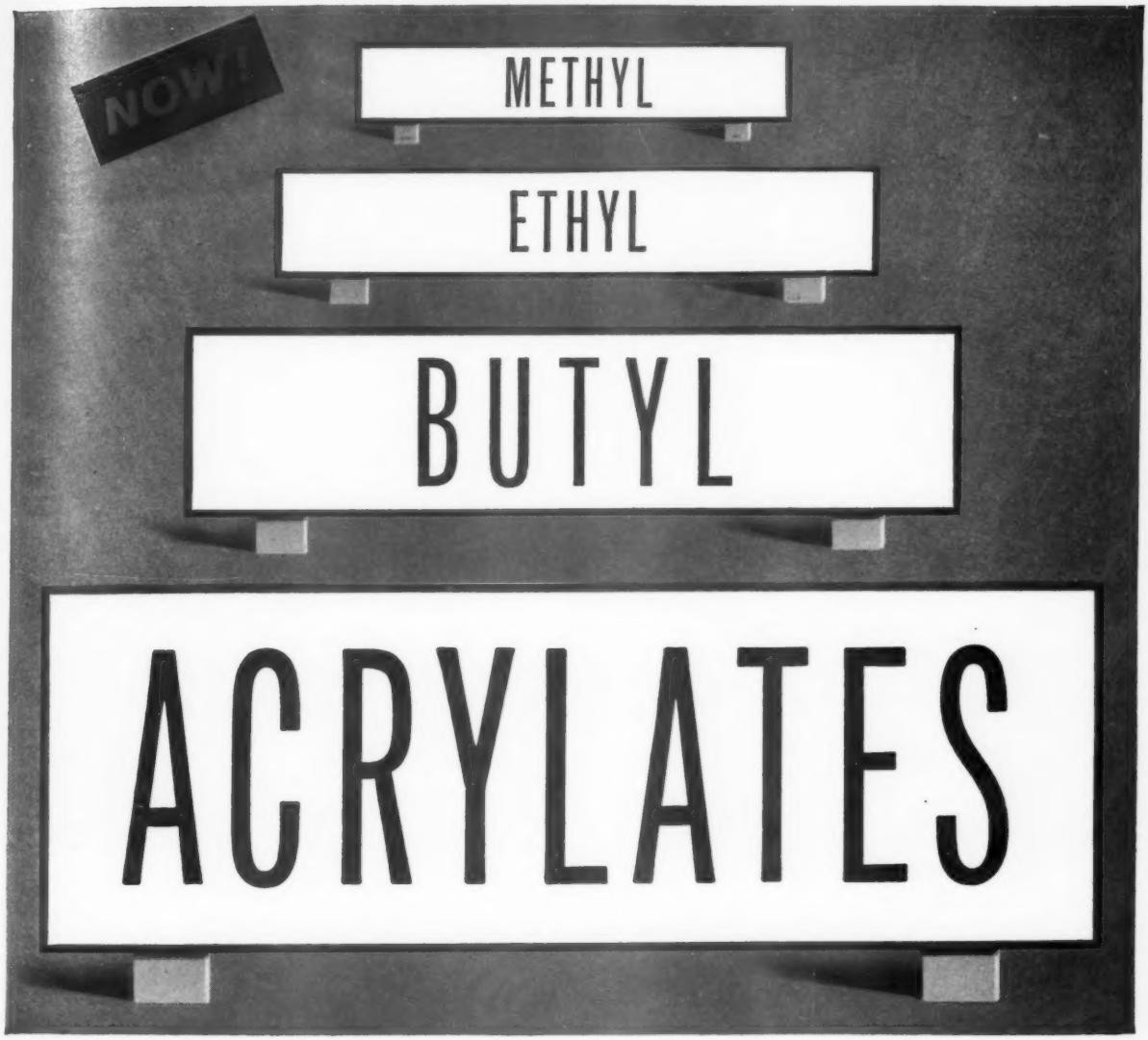

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TIME OF TRANSITION FOR ALKYD RESINS

Panel members of Symposium on Time of Transition for Alkyd Resins. Left to right: T. Mika, James R. Eiszner, J. N. Butler, Dr. Edward G. Bobalek, Dr. Marvin W. Formo, Dr. J. Scott Long, and Dr. Herman J. Lanson.

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The above papers were presented at the symposium: Time of Transition For Alkyd Resins, which was featured at the Glycerine Division Meeting of the 32nd Annual Convention of the Association of American Soap & Glycerine Producers, Inc., held in New York on January 22, 1959.

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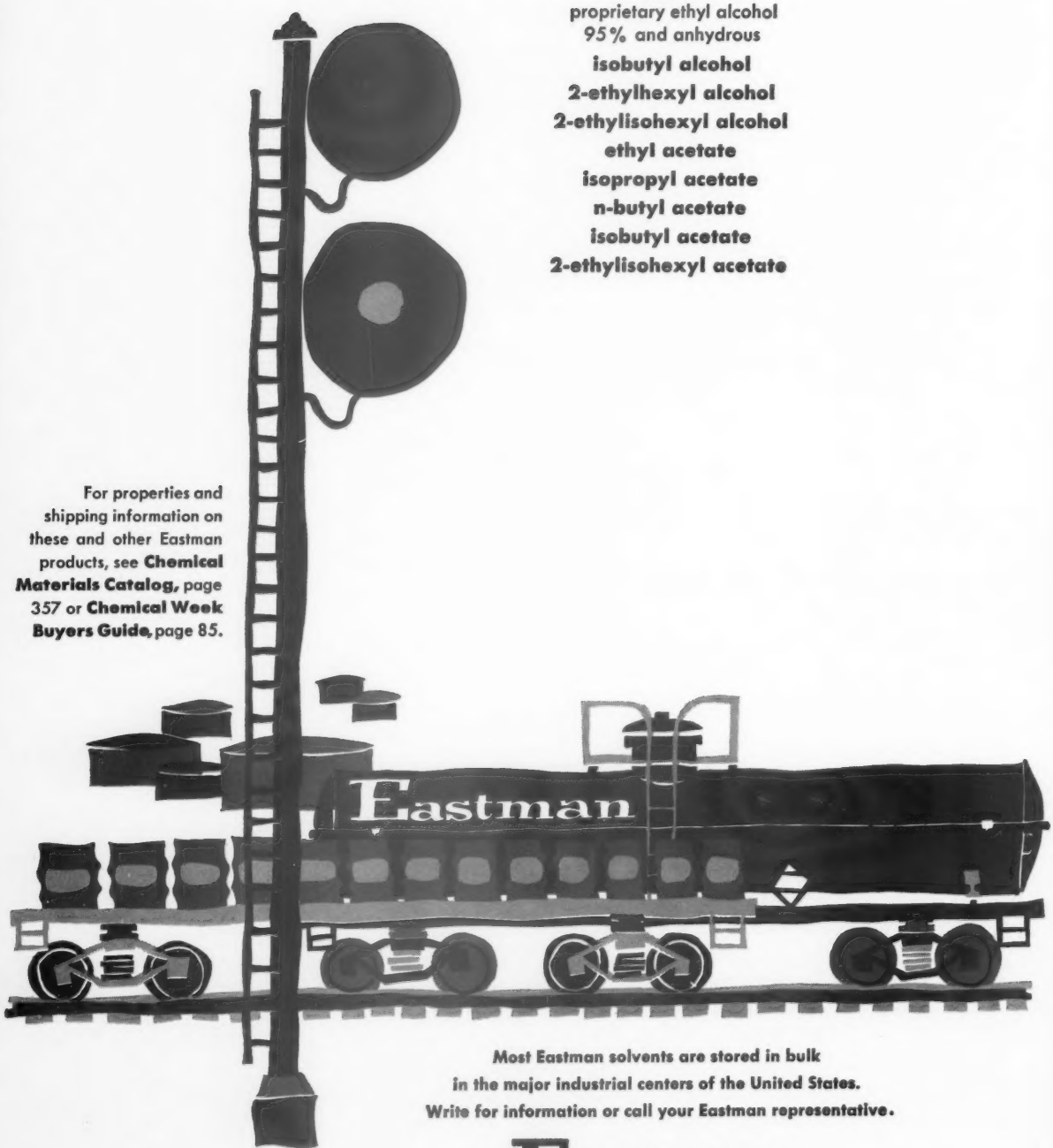

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ALKYDS in TRANSITION

By
Dr. Herman J. Lanson*

THE transition in the paint industry from vehicles based entirely on naturally-occuring materials to those of a synthetic origin has been an accellerating process. In many ways, it has paralleled the phenomenal growth of the plastics industry. This is not surprising when we recall that historically every development of an important new synthetic polymer for fabrication use has had its counterpart for use in protective and decorative coatings. Thus, today we have vinyl plastics and vinyl coatings, phenolic plastics and phenolic coatings, alkyd plastics coatings, and so on with nearly every industrially important synthetic polymer.

It has been recently said the "old plastics never die, and rarely fade away." Even old timers, such as phenolics and cellulosics continue to maintain high levels of usage in the face of an array of new synthetic polymers. Although alkyd resins have been used in protective coatings for over twenty-five years, their consumption continues to increase, and even today, they rank as the most important synthetic coating resin and constitute about half of all the resins used in organic coatings. The remainder is divided in order of importance by rosin derivatives, styrene, cellulosics, urea-melamine vinyls, phenolics, coumarone-indene, acrylics, epoxies and silicones. Moreover, it is likely that alkyd resins will retain their number one position in organic coatings for some years to come. It is of interest to consider the reasons for the remarkable growth in the use of these materials and indicate possible future trends in their application.

No resin-forming reaction lends itself to greater useful variation and modification than the formation of alkyd resins. While alkyd resins are based on three fundamental building blocks—oils or fatty acids, dibasic acids and polyhydric alcohols, the permutations and combinations possible with only three basic components become enormous. Nature has been generous in providing us with a wide array of oils and fatty acids of varying degrees or unsaturation and chain length. Variation in this component alone allows us a wide gradation in film properties, from a soft, colorless plasticizing film to a hard, tough, tack-free film. In the formation of oil-modified alkyd resins, the degree of polymerization is sufficiently high that only a small amount of oxidative cross-linking is necessary to cause the film to become dry. Thus, lower-cost oils of lower unsaturation can be used to form air-drying alkyds, and herein lies very favorable economic factors which have greatly contributed to the remarkable growth in the use of alkyd resins in recent years. I refer specifically to the plentiful supply of low soybean oil and the availability in recent years of refined fatty acids from tall oil.

Polyols

In the area of the polyhydric alcohol component of alkyd resins, glycerine still remains the workhorse, although increasing use of the pentaerythritol, various glycols, sorbitol, trimethylolethane and trimethylolpropane continues. The latter two have recently become available in larger quantities at lower prices. More recently, increased production facilities for 1, 2, 6—hexanetriol have come "on stream" with a consequent price drop. Time limitations preclude a discussion here of the different properties imparted by the various polyols and polyol combinations, but suffice to say that the resin design chemist has in the polyol component, another means of varying the film forming properties of the alkyd resin.

*Technical Director, U. S. Vehicle & Chemical Co.

Polybasic Acids

Finally, we come to the third basic component of alkyds, namely, the polybasic acid. By far, the most important is phthalic, which is used in the form of its anhydride. Other dibasic acids such as adipic, azelaic and sebacic are being used where more flexible films or greater plasticization is required. While isophthalic acid has been available for sometime, a new efficient process for the oxidation of mixed xylenes, and the separation of the isomeric dibasic acids, portend the early availability of isophthalic acid at a new low price. This material, unlike phthalic anhydride, will not form cyclic structures, and allows higher molecular weight polymers having considerably higher heat resistance. While the use of isophthalic acids entails some processing difficulties, it imparts some unusual properties to alkyd resins containing it, and will undoubtedly become a useful "building block" in the hands of the experienced resin chemist.

I have briefly discussed the basic components of alkyd resins to show the wide difference in properties and performance that can be obtained by variation of the three basic components of a simple oil-modified alkyd resin. Moreover, the degree of oil or fatty acid modification has a great bearing on the properties of alkyd resins. Thus, we can readily understand the amazing versatility and usefulness of these materials.

Polymeric Mergers

Just as the business climate these days has been described as the "era of mergers," the field of synthetic polymers could be similarily described. The greatly increased utility of plastics is in a large measure due the joining together, either physically or chemically, two or more polymeric species. For example, the brittleness and low-impact strength of polystyrene has previously been a deterrent to its expanded use. This can be overcome, chemically, by copolymerizing styrene with another monomer such as butadiene or acrylonitrile, or physically, by blending polystyrene with as little as 10-15% of GR-S rubber. Many recent advances in synthetic polymers have resulted from what we might term "polymeric mergers," which have given properties that surpass those given by the individual components. In a similar manner, the already wide spectrum of properties of alkyd resins is broadened by its use with a wide variety of reactive chemicals and other resinous materials, In fact, it becomes readily apparent that alkyd resins have the distinction of participating in more "polymeric mergers," than any other singly class of resins. Figure 1 depicts a simplified theoretical structures of a long oil and a short oil alkyd resin. In (a) it can be readily seen that the large number of long chain fatty acid groups impart a predominant non-polar character to the molecule which promotes compatibility with non-polar resinous materials such as chlorinated rubber and chlorinated paraffin. In (b), the high proportion of free hydroxyl groups impart not only polarity but centers of potential reactivity with a host of hydroxyl-reactive materials. Moreover, unsaturation in the fatty acid groups allow interpolymerization with many vinyl monomers, epoxidation and other reactions of the double bond. Table I is a listing of the many polymeric materials and reactive functional materials with which suitablydesigned alkyds are modified and used to impart improved film-forming properties. The use of oil-modified alkyds with nitrocellulose in lacquers is perhaps the first "merger" that resulted in a remarkable growth in the use of nitrocellulose lacquers. The upgrading effect of the alkyd in improving the gloss, adhesion, durability and build of lacquers is well-known to all in the coatings field. This valuable com-

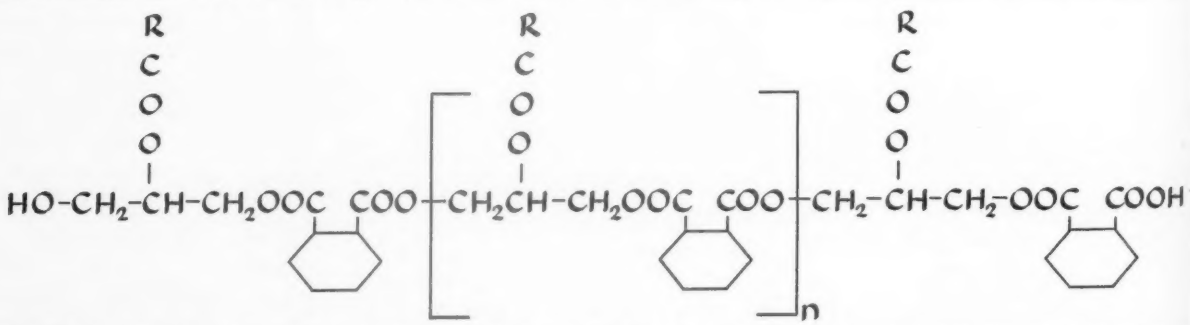


Figure 1(a). Theoretical structure of a long oil alkyd based on a 1:1:1 mol ratio of glycerine-phthalic anhydride—fatty acids. (ca. 60.5% oil)

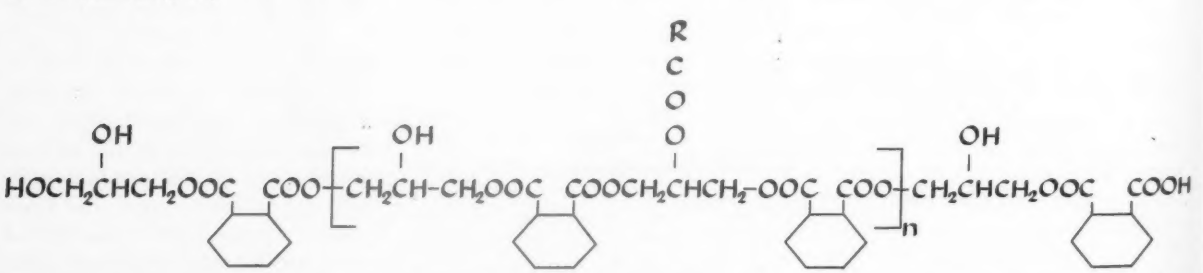


Figure 1(b). Theoretical structure of a short oil alkyd based on a 6:6:2 mol ratio of glycerine-phthalic anhydride—fatty acids. (ca. 31.2% oil)

Alkyds with	Nitrocellulose
	Urea-formaldehyde resins
	Melamine-formaldehyde resins
	Phenolic resins
	Chlorinated rubber
	Synthetic latices
	Vinyl resins
	Chlorinated paraffin
	Epoxy resins
	Polyisocyanates
	Silicones
	Reactive monomers
	Cellulose acetobutyrate
	Phenolic varnishes
	Polyamides
	Natural resins
	Monobasic aromatic acids

Table I. A list of polymers and reactive functional materials that may be used to modify alkyd resins.

bination will undoubtedly continue as long as nitrocellulose lacquers are used. The combination of alkyds with urea and melamine-formaldehyde resins remains the "back-bone" of industrial finishes. The use of phenolic resins with alkyds is an "old-timer" in which the excellent gloss retention and durability of alkyds is combined with the water and alkali resistance of phenolics. Medium and long oil alkyds have been used for some years with chlorinated rubber and impart desired toughness and exterior durability to concrete floor paints, swimming pool paints and corrosion-resistant finishes.

Readily-emulsifiable alkyds have been developed for use with synthetic latices. It has been shown that the use of these resins in styrene-butadiene latex paints, improves adhesion, freeze-thaw stability and early washability of these paints. Recently, our laboratory worked on the development of special alkyds for use with PVA paints. One of these, when used in a very high pigment volume paint, gave a material that, when brushed on a thin sheet of porous paper dried to a film having remarkable scrub resistance. Latex paints need better early toughness and water-resistance and better adhesion to various surfaces. Specially-designed alkyds offer great promise in overcoming these deficiencies.

Alkyd Combinations

Many medium and short oil alkyds are compatible with dydroxyl-modified vinyl chloride-vinyl acetate copolymer and this combination of fast-dry, excellent resistance and durability is specified in a number of finishes for military use. Combinations of chlorinated paraffin, long oil alkyd and linseed oil have recently found application in the formulation of blister and stain-resistant house paints and, to date, the durability properties appear excellent. In this area of exterior paints, a large paint manufacturer is now offering a house paint based on a long oil isophthalic alkyd and outstanding wearing properties are claimed. There are many interesting possibilities in the combination of alkyds with epoxy resins. We have already noted that oil-modified alkyds contain free hydroxyl groups and these are present sites for reaction with polyisocyanates. The resultant products possess faster dry, better chemical resistance and abrasion resistance. The recent increased availability and lower costs of diisocyanates make this an attractive field for further exploration. The use of hydroxyl-containing oil-free alkyds with isocyanates and isocyanate adducts is well established and is certain to grow. These coatings possess a high degree of chemical resistance, adhesion and abrasion resistance and in recent years, have been used in Europe in increasing quantities.

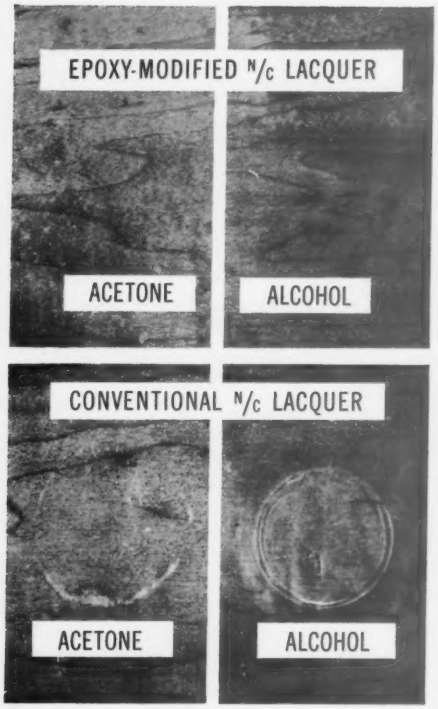
Silicone resins, which rate very high in heat resistance, but low in film strength, have been combined chemically and physically with oil-modified and oil-free hydroxylated alkyds. The resultant vehicles possess good film strength and very good to excellent heat resistance depending on the type of formulation. Reactive polysiloxanes chemically combined with oil-free isophthalic and terephthalic alkyd possess outstanding high-temperature resistance, and offer a promising area for the development of coatings for our missile and rocket program.

The unsaturation in the fatty acid groups of oil-modified alkyds allows interpolymerization with a wide variety of reactive vinyl-type monomers. Increased production of these monomers have led to lower prices, which has stimulated development of new and improved "copolymer" alkyds. Mathacrylated alkyds are particularly useful in coatings for metal decorating. These coatings cure rapidly, have excellent flow, gloss and color retention and excellent durability and toughness. Indicative of the research activity in this field is a recent patent in which methacrylic acid and styrene are copolymerized with a drying oil using benzoyl perioxide as the catalyst, the resultant polymeric carboxylic acid being esterified with glycerine. Outstanding adhesion under high moisture conditions is claimed for this resin.

Alkyd Emulsions

Any discussion related to alkyds and coatings would be incomplete without consideration of the great consumer demand for water-based systems. While we have briefly touched upon the use of readily-emulsified alkyds as a modifier in styrene-butadiene and PVAc latex paints, several fine particle size alkyd emulsions have been made available for coatings use. These emulsions possess excellent stability and can be readily pigmented into both flat and gloss architectural finishes. However, to date, these products have not made any great inroads into water-based paints now based on synthetic latices. Nevertheless, these alkyd emulsions are relatively recent developments and with the considerable research activity in this field, improved products of this type are almost a certainty. It is quite possible that when these new products are forthcoming, a synergistic combination with synthetic latices will evolve and the resultant paints made

(*Turn to page 107*)



These panels, subjected to identical treatment, show the resistance of epoxy-modified nitrocellulose lacquer to spills of alcohol or acetone (nail polish remover).

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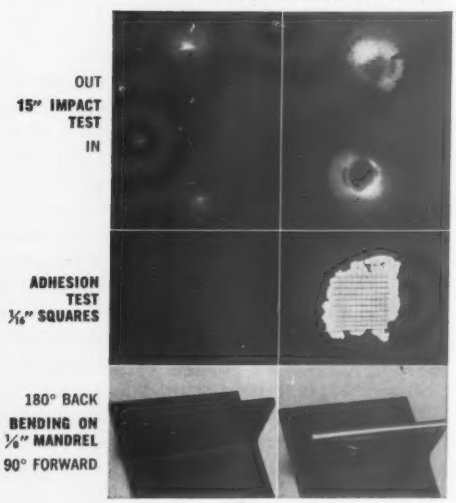

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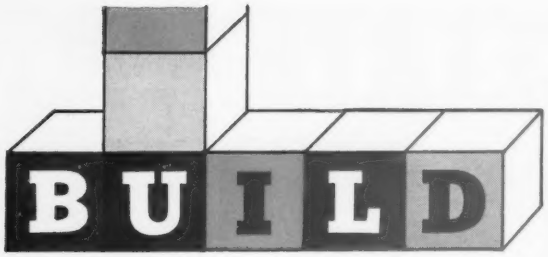

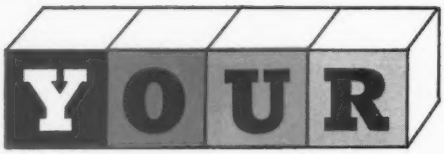

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EFFECT OF CHEMICAL CONSTITUTION ON PROPERTIES OF ALKYD RESINS

By
Dr. Edward G. Bobalek*

ALKYD resins are special members of the broad family of polymeric esters. Polymeric esters are condensation resins derived from esterification of polyols with polybasic acids. If a diol is reacted with a dibasic acid in equivalent proportions (Equation I) here n can be any value from one to a very large number. The chance of getting large values of n increases as the extent of esterification of the functional group increases.

Carothers, Flory, Kienle and others have developed to a high degree the theory where the molecular weight and distrubtion of polymer sizes making up the average can be predicted precisely if we know (1) the exact proportions of the functional groups (2) the extent of reaction and (3) the true functionality of the system.

If the functionality, i.e. the number of reactive functions per monomer molecule, is greater than 2, the polyester reaction systems gel at some degree of reaction less than 100%. This extent of reaction at which gelation occures (i.e., the gel point) can be predicted to an accuracy of ±5% if again the three facts above listed are known about the system.

The theoretical relations for predicting molecular weight, molecular weight distribution and gel point are described well in the literature and for simple polyesters they predict results which are more accurate than can be determined by ordinary experiments. These developments of statistical theory will not be repreated here. Our concern is with alkyd resins and not polyesters in general. For alkyds, as they are known to the practical paint formulator, the exact theoretical developments of Carothers, Flory and others apply only as a rough guide. Alkyds are among the most complicated and least known species of the polyester family because (1) rarely is the exact stoichiometry known (2) the extent of reaction of the known functional groups is difficult to ascertain—rarely is the finished product an equilibrium system; i.e., where esterification and exchange reactions are in thermodyamic balance—and (3) the functionality is uncertain; i.e., all the side reaction possibilities are not clear.

The complicated and largely unknown alkyd resins are good paint vehicles. The near relatives—the orderly polyesters—are rarely useful paint binders. For a long time to come, knowledge of coatings alkyds will be advanced by the old fashioned approach of inductive accumulation of data from a variety of trial and error experiments. Deducing properties from first principles will for a time have to be left as an exercise for the edification of researchers who deal with well defined systems. However, we cannot discount entirely the deductive approach. In general, the failure of good theory is its inappropriateness and not its inadequacy. In our studies of more complicated alkyds we can't ignore principles demonstrated well for ideal polyesters. Alkyds, being polyesters, should not contradict the conclusions of the pioneers who developed polyester theory. Rather, our research must look for the explanation of unusual pro-

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Equation I.

perties by seaching for superposed complexities rather than by assuming that alkyds contradict the theory of polyesterification. Always, even in our trial and error experiments, we should look for developments which may help us to broaden the base of a theory so that it covers more situations—even the paint alkyds.

Nature of an Alkyd Resin

An alkyd resin in soluble form is essentially a linear polymer (perhaps with some branching). Usually it is made in great part from dibasic acids and polyols of functionality of three or greater, plus a monobasic acid modifier. Besides being an essentially linear polymer, an alkyd also is in part a synthetic oil (i.e., a product of esterification of vegetable oil acids with a polyol).

As a high polymer in solution, an alkyd resembles a lacquer resin in that it can form a film by solvent evaporation. If the monobasic modifier is saturated, that is, nonoxidizable, this is the end of its film-forming properties. Where an oxidizing oil is used, the solvent-cast film is only an intermediate. The alkyd film now undergoes the normal reactions of drying oils to build complicated, cross-linked molecules. The poorer the drying oil characteristics of the alkyd, the more reliance will need to be placed on building the molecule to a size and structure so as to yield a good solvent-lacquer type film. The greater the drying oil functionality, the more are the liberties which can be taken with construction of the molecules which are to be deposited from solution. Sometimes this is desirable. For example, a low molecular weight and branced structure may yield a poor film right after solvent evaporation, but it does have desirable characteristics in solution from the viewpoint of paint making, storage stability, fluidity, and paint application. The deficiencies in film forming properties are overcome later through the drying-oil reactions. Whether in particular instances the character of the film should be determined by the lacquer or by the drying oil character of the alkyd is a question which can be answered by considering how the alkyd will be used. It is important, however, to recognize that this clear dichotomy exists in defining alkyd character and that a compromise needs to be sought between two aspects of alkyd resin properties.

High Polymer Aspects

All alkyds are polymers produced through esterification. These polymers need not be *high* polymers. For example, a very long oil alkyd may be of very low molecular weight—so low that the individual molecules should be considered only as a special sort of drying oil monomer. Other alkyds, particularly the oil-free types (benzoic acid or rosin modified), may contain a large proportion of very high molecular weight molecules. In general, the greater the molecular weight the more complete is the film formation immediately after solvent evaporation and the less reliance, if any, needs to be placed on *in situ* drying oil or thermal polymerization reactions to improve film properties. In general, the lower the solution molecular weight, the greater must be the latent drying-oil polymerization functionality of the resin. Most commercial alkyds are somewhere in between—where both the thermoplastic resin structure as well as the delayed reaction possibilities for thermosetting reactions are important. This middle position is very important because the *paint uses* of polyesters require different properties than do other uses for polyesters. The significance of this difference can be illustrated most clearly by contrasting the paint formulation needs with those of other usages such as using polyester to make *fibers*. The idea we will develop in this comparison of paint film versus fibers requirements is the importance of the property we call "The Tendency to Crystallize." [Here my comments are drawn largely from the classical review paper of R. Hill and E. E. Walker, J. Polym. Sci. *3*, 609-630 (1948)].

To a greater or lesser extent, linear polymers tend toward a microscopic structure which can be described as a dispersion of ordered regions called crystallites within a continuum of amorphous polymer. The proportion of crystallite to amorphous polymer and the relative dimensions and distribution of the two regions largely determine the mechanical and some of the chemical properties of the polymer. The size of the crystallite units can be so small that single polymer molecules can participate in the structure of both the ordered and adjacent disordered regions.

An ideal fiber cannot be had unless crystallinity is present to a high degree, and the molecular weight of the polymer is so high, that on the average there is much sharing of the two regions between different parts of a single molecule. Types of molecules where intermolecular forces are high (i.e., through hydrogen bonding) and where the geometry is most favorable for orderly stacking of parts of molecules into crystallites are the best fiber formers. Here the cohesive forces between molecules are at a maximum. This means that such polymers are less prone to develop affinities for, or adhesive properties, toward dissimilar materials. This is equivalent to saying that all the important features of a fiber forming polymer are opposed to the prime role of a paint resin—namely, adhesive properties. Virtually every detail of structure which enhances fiber forming characteristics will be opposed to wetting of pigments by the polymer and to adhesion of films to various substrates. The tendency to crystallize reduces the solubility of polymers in paint solvents. The best fiber forming polymers are too insoluble in paint thinners to allow for their use in paint formulation.

To illustrate this point, let us look at the problem of materials choice in terms of polyol constituent, where we take the simple case of an ester with terephthalic acid.

Isolated side groups destroy symmetry and oppose crystallinity. They do favor solubility and the preservation of the amorphous state. The amorphous state can be glassy or plastic. The larger the side groups and the greater the dissymmetry, the less will be the crystallinity, the melting point, and the temperature when the glassy state becomes rubbery. Also the more soluble will be the polymer. These features, which are opposed to good fiber forming properties, are carried to an ultimate degree in alkyd polyesters for

Glycol	Crystallinity (X-ray evidence)	Fiber forming	m. p., °C
$HO(CH_2)_2OH$	yes	yes	256
$HOCH(CH_3).CH_2OH$	no (glassy)	no	122
$HO(CH_2)_3OH$	yes	yes	221
$HOCH(CH_3).(CH_2)_2OH$	no (glassy)	no	< 100
$HO\text{-}CH(CH_3).C(CH_3).CH_2OH$	yes	yes	140
$HO\text{-}CH_2\text{-}CH(O\text{-}C(=O)\text{-}R)\text{-}CH_2OH$	no (rubbery)	no	< 0

Table I. Esters of Terephthalate Acid.

paint vehicles.

Tables I and II suggest that where the stearic arrangement or the presence of bulky side groups prevails so as to destroy the symmetry required for crystallization, we drop the melting point, which makes the polymer tend to be more glassy or rubbery. At near room temperature, coatings polymers must be rubbery (low glass point) which is the reverse of what is needed for fiber forming polymers.

In general, copolymerization of different polyol and dibasic acid constituents will tend to drop the melting point, glass point, and hence will enforce more the properties we associate as being consistent with the character of polymers. Design of alkyds or polyesters for coating and fibers uses the same data and the same principles. However, what each area of interest desires in properties the other side rejects. For coatings resins, the trend is to promote the adhesive and hence rubbery character of the polymers. This can be overdone. For example, polyesters like hexadecyl palmitate melt at 53-54 compared to 71°C for the corresponding C_{33} hydrocarbon. By putting in bulky side groups, as by reaction of sebacic acid with glycerol-oil monoglyceride, we can reduce the glass transition temperature so low as to have a sticky, non-film forming liquid at even subzero temperatures. To get ideal fibers we need to reduce crystallinity somewhat so as to get spinnability and drawing at temperatures less than the decomposition point of predominantly crystalline polymers. To get ideal paint films we need to retain some residue of the crystallizing tendency in predominantly amorphous polymers so that the film has some firmness at temperatures where films are deposited from solution. Our basic film, after solvent evaporation from the vehicle, must not be too sticky or too glassy. The choice of the alkyd forming monomers, from the point of view of their capacity to increase or decrease the crystallization tendency of the polymer, does much to determine whether our film forming resin will be too tacky or too brittle (or short). Irrespective of molecular weight, the greater the mole per cent of repeating units having crystallizability tendencies, the harder and more brittle will be the resin. It is an interesting fact that the melting point is less sensitive to molecular weight than it is to the geometric complexities and molecular structure of the repeating units which make up the polymer.

All of these factors which control the crystallization tendency are complications which are superimposed upon the complications coming from the drying oil reactions. Where we have a drying oil functionality in the polyester, much of the film character is dominated by the drying oil, but the high polymer drying oil modification, a polyester alkyd derived from terephthalic or isophthalic acid has a greater residual tendency to crystallize and a higher melting point than one made from orthophthalic acid.

Alkyds or Drying Oils

The theory of drying oils is very extensive. At the risk of oversimplifying, here we will attempt to condense the theory into a few statements.

1. The reactive functions are double bonds in an aliphatic chain. The number of double bonds should be more than two and less than four. Less than two is not enough; more than four makes the competitive reaction of chain degradation too pronounced. The geometric arrangement of the double bonds influences the probability of achieving a unit of reaction between two aliphatic chains in the same or in neighboring oil molecules. Each oil molecule contains two or more aliphatic chains having polymerization functionality.
2. The oil must be able to form a gel by forming complex molecules. To do this, the number of *effective* polymerization functions per oil molecule must exceed two. This means that at least two vegetable oil acids having two or more double bonds must be present in each oil molecule.
3. If the relative efficiency for oxidative polymerization per aliphatic vegetable acid is low, then the number of oxidizable vegetable acids per oil molecule must be greater than if each vegetable oil acid has a high efficiency.
4. In a glyceryl alkyd, the drying oil functionality increases as molecular weight of alkyd polyester increases, because longer molecules have more vegetable acids per molecule.
5. The molecular weight of the alkyd oil ester and also its drying oil functionality are controlled by using

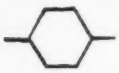
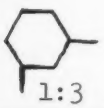
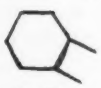
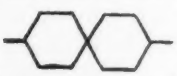
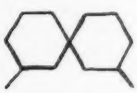
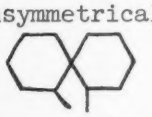
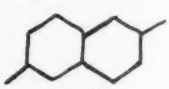
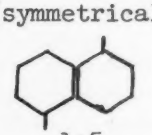
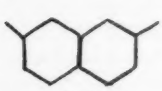
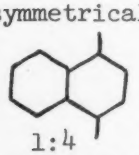
Acid	Crystallinity Character	Polymer m.p.	Film Forming Properties
 1:4 (symmetrical)	highly crystalline	256	excellent
 1:3 (unsymmetrical)	non-crystalline	102-107	fair
 1:2 (unsymmetrical)	non-crystalline	low	none
 (symmetrical)	highly crystalline (hexamethylene glycol ester)	346	too high melting point to spin properly
 (unsymmetrical)	glassy	156	poor
 (unsymmetrical)	glassy	132	none
 2:6 (symmetrical)	highly crystalline	252-260	good
 1:5 (symmetrical)	crystalline	226-230	spins and cold draws
 2:7 (unsymmetrical)	slight	220	spinnable--slight indition of drawability
 1:4 (symmetrical but bulks)	non-crystalline	170	none

Table II. Ethylene Glycol Esters of Aromatic Dibasic Acids.

quantities of polyol in excess of the 1:1 equivalence required to react with the dibasic acid and neutralizing excess hydroxyls with monobasic vegetable oil acids.

6. The more the degree of polymerization of the polyester is limited, the higher must be the effective drying oil functionality of the monobasic modifier to provide useful films.

Applying these principles leads us to a conclusion that we can produce alkyds of equivalent drying speed in two ways: (1) Develop a polyester of high degree of polymerization using fatty acids of low efficiency, or (2) develop a polyester of low degree of polymerization using fatty acids having greater polymerization reactivity. Cottonseed oil modified pentaerythritol phthalate is an example of the approach (1) and a glyceryl-phthalate alkyd modified with dehydrated castor or china-wood oil acids is an example of (2). It they dry at about the same rate to form a solvent resistant film, they have about the same effective drying oil functionality even if the polymers differ markedly in composition and structure. Although these are equivalent from the viewpoint of their formulation properties as drying oils, other formulation properties may be vastly different. The nature of some of these other formulation properties merits further comment.

Other Formulation Properties

Solubility

Here we are concerned with what solvents need to be used and the effect of the solvents on viscosity. Where stable solvent-alkyd mixtures can be made, the viscosity of the mix can depend on a variety of factors, namely:

a) the viscosity of the solvent,
b) the solvency power (solubility parameter) of the solvent,
c) concentration of solvent.

It has been established by independent investigators Shaw and Johnson, Off. Dig. *339*, 216 (1953), Bobalek et al., Ind. Eng. Chem. *48*, 1956 (1956), and Reynolds, off. Dig. *394*, 1174 (1957) that alkyds do not form in solution a true molecular dispersion. Rather, association complexes form, the size of which depends on the nature of the solvent and the drying oil content of the resin. For unsaturated oils, in strong solvents like ketones, the association is very slight. For bodied drying oils (like linseed) or long oil alkyds, the association tendency is greater and the complexes are very stable, i.e., less dependent on changes in solvency of the thinner and upon alkyd concentration. In any particular solvent, the stability and size of these complexes increase with degree of complexity of the polymer. The side reaction of polymerization of the oil is the major cause of increased complexity rather than an increase in the degree of esterification; but the two effects are not independent, since increase of ester degree of polymerization increases oil functionality of the alkyd molecule. This has marked effects on such properties as drying rate and storage stability of paints made from these alkyds. The tendency to form association complexes in solution is related to speed of film formation in solvent-free films. The following seems to prevail.

Tendency to form association complexes in solution and speed of film formation and toughness of films produced (after solvent evaporation) are enhanced by:

a) modification with reactive oils,
b) increase in degree of polyesterification,
c) increased oil content,
d) increasing the degree of branching complexity of the polymer.

If the objective is to produce speedily air drying films, these are obviously the directions one would proceed in alkyd formulation.

However, suppose the alkyd is intended as a modifier for resins like nitrocellulose, aminoplasts, and others. Here those factors which limit solubility (i.e., which increase association in solution) will oppose solubility of one resin in the other. Where we want to mix alkyds with other resins, we need such as can be dissolved in solvents without forming large association complexes. To achieve this circumstance, we promote other variables, namely:

a) limit the molecular weight of polyester,
b) use oils less prone to favor association complexes, i.e., non-drying oils,
c) decrease oil length,
d) decrease branching complexity of polymer (e.g., by using triols instead of higher polyols.)

That is, we try to minimize the cohesive attractions of alkyd molecule for alkyd molecule in order to increase the solvency interation with solvents and other resin molecules.

Because we have at least these four leverages for tailor making molecules to favor either one solubility direction or another, there are a large number of ways we can proceed in the design of polymers having equivalent utility for a particular need in paint formulation.

Chemical Resistance

This embraces factors like rates of heat degradation, discoloration, water swellability, susceptibility to attack by chemicals, and oxidative degradation.

By and large, alkyd resins are not highly resistant to chemical degradation. The *forte* of alkyd formulation is superior control of physical properties of films and such solution viscosity characteristics as make for easy formulation, manufacture, and application of paint. If we do this by controlling variables mentioned above, we accept as a secondary consequence some small variations of chemical durability, for better or for worse. As long as we remain in the polyester family of resins, it is unlikely that we will find two useful resins which differ tremendously in durability to chemical exposures. We can leave the subject of alkyds with the thought that ultimates of chemical resistance are not to be found in the alkyd polyesters. What we do find, however, is the maximum capacity for varying other formulation properties of paints over a wide range and to a degree that has not been reproduced in any other type of paint vehicle system. If we want chemical durability to a high degree, we will need to work with polymers that are more interactable to manipulation in paint formulation.

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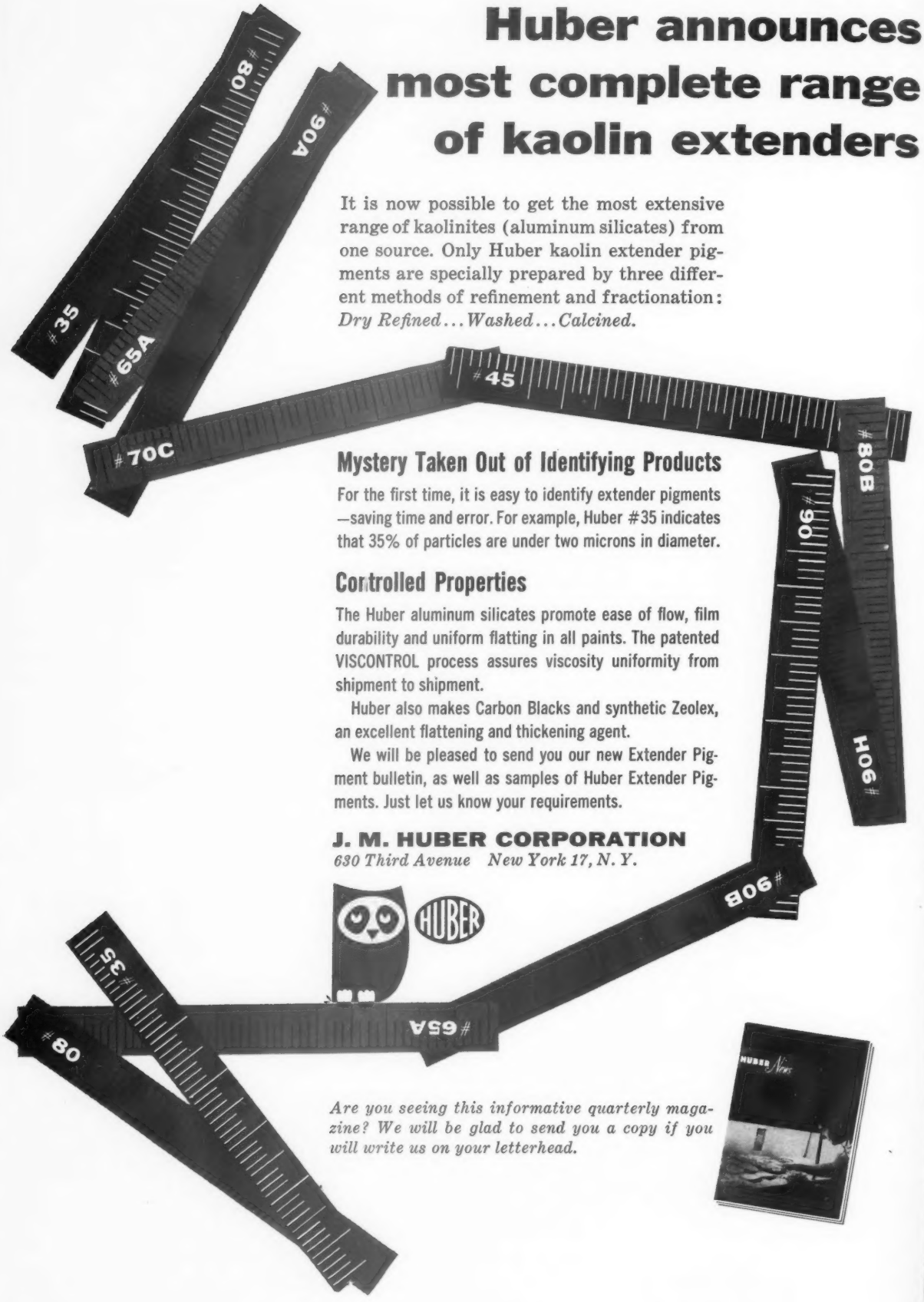

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WATER THINNED RESINS— WHERE THEY STAND

By
Marvin W. Formo
and
W. Blair Smallwood

THE fact that polyhydric alcohols reacted with polybasic acids to form resinous materials was recorded over one hundred years ago. These were the first alkyd resins or polyester type resins known. About 1901 Watson Smith reported the reaction of phthalic anhydride with glycerine produced a resinous material (1). This was really the birth of the commercial alkyd resin field we know today. In the early 1900's General Electric began a study of the reaction products of phthalic anhydride and glycerine. Early commercial alkyd development was done by such men as Callahan, Kienle, and Ferguson. It was Kienle who named these reaction products "alkyds." It was also Kienle who first investigated oil modification of alkyds in the early 1920's. (2). First commercial production of oil modified alkyds was begun in the late 1920's. Growth since that time has been spectacular. The volume has increased over one hundred fold in the past 35 years. During 1957, the United States Tariff Commission reported that 540 million pounds of alkyd resin solids were produced. (3)

The authors of this paper are associated with Archer-Daniels-Midland Company

Water-Thinned Systems

This much is an old story with which you are all familiar. No doubt you are all more than a little aware of the newer story, that is, the development of water-thinned vehicles. Before World War II we had only water–thinned casein paints or oil modified casein paints. Although sizeable quantities of these paints were made and sold, they weren't the most durable coatings. They washed off, chalked off, or were consumed by mold.

The end of World War II and the release of items to the civilian market brough forth styrene-butadiene latex, a product of this country's research on synthetic rubber. Styrene-butadiene was soon joined by polyvinyl acetate homopolymer and copolymer emulsions, acrylics, alkyd emulsions, oil copolymer resin emulsions, and water solubilized vehicles. Until now the principal uses of the paints produced from these vehicles have been in trade sales items. Approximately 60% of all interior flat paints and 50% of all masonry paints are water-thinned. Further growth is expected in trade sales in concrete floor paints and architectural enamels. Today, however, there is almost an urgent interest in water-thinned paints for industrial applications. At first, only industrial primers were possible. Now, new developments in raw materials put light-colored industrial top coats close at hand.

Water-thinned systems are popular with the paint consumer for these reasons:

1- Eliminate flammable and toxic solvents
2- Reduce objectionable odors
3- Apply easily
4- Clean up easily.

The paint manufacturer also benefits because:

1- Water-thinned paints permit him to reduce the number of solvents he must use and store. In compensation for this, however, his inventory of stabilizers, modifiers, and other additives must be increased.
2- He no longer faces a problem of disposing of wash solvent.

These alone are resons enough why the consumer, be he manufacturer or home owner, likes to make and use water-thinned paints. There are two other dominant reasons for interest, reduction of air pollution and freedom from fire hazard.

Air Pollution

Air pollution is a very urgent consideration for paint manufacturers and industrial users of paint. The citizenry of this country is justifiably demanding pure air to breathe. Researchers of the problem have pointed fingers at a number of sources of air pollution. One of these sources is the industrial paint user. Obviously something is going to be done. For instance, here is a quotation from Special Report 9 of the Air Pollution Control District, County of Los Angeles, dated July 1957.

> "Another possibility which is being investigated, is that of changing the type of solvent used—substituting non-reactive compounds for the reactive solvents that form smog. The use of water-based paint is being stimulated by the APCD, but has not yet been demonstrated to be feasible for all purposes. Because of the importance of the contributions of solvents to smog, and the urgency of cleaning up the air of Los Angeles County, District officials are not disposed to delay the enactment of such a rule."

Although there is apparently still no ordinance on the books or even proposed which would completely prohibit the use of solvent systems, the air pollution people are being very diligent along other approaches. Industrial users of solvent-thinned coatings are required to install elaborate and expensive systems to remove evaporated solvent from their ventilating discharges. It is also interesting to note that the APCD keeps tab on all solvents shipped into Los Angeles.*

*Although the protective coatings industry should show concern for the air pollution problem, we should also be aware that there are much larger offenders. Out of 1650 tons of gases per day released into the Los Angeles atmosphere, it is estimated that 130 tons result from solvent loss from coatings applications, 70 tons from degreasing, 30 tons from dry cleaning, and 100 tons from the manufacturer of pharmaceuticals, paints, and paint removers. Automobile exhaust accounts for 1000 tons of gas per day.

Fire Hazard

Fire is a very real hazard to all. Participants in the protective coatings industry know what fire can do. Minor or catastrophic, we have all had some experience with this destroyer of lives and property. A major fire will often cripple a company to such an extent that the business will not survive. In fact, 72% of those companies which sustain a major fire fail within 3 years. Forty-three percent never open their doors again. Ferocious fires fed by flammable finishes have catalyzed the development of industrial water-thinned paints. The manufacturer who is able to remove hazardous materials can expect fewer accidents, lower insurance rates, less need for storage space, and simplification of baking facilities.

Water-Thinned Vehicles

We have now reviewed important factors involved in the ever-growing concern for resins which can be thinned with water. The interest in synthetic latices started it all. Not far behind though were water-thinned vehicles which contain oil resins. ADM and other oil and resin producers have been vitally interested in the latter. The group can be separated into four categories:

1- Long oil alkyds as modifiers for existing non-oil latices
2- Alkyd emulsions
3- Copolymer emulsions in which the oil or alkyd component is an intimate part part of the emulsion
4- Water solubilized products for gloss application as architectural enamels and industrial topcoats.

Consider now each of these groups in somewhat more detail.

Long Oil Alkyds

These are used as modifiers for existing non-oil latices. Styrene-butadiene, acrylic, and PVA emulsions may be modified with alkyds with the following improvements:

1- Good initial scrub resistance
2- Improved washability
3- Good pigment binding and wetting
4- Improved water resistance
5- Improved freeze-thaw resistance
6- Higher pigmentation for better hiding
7- Improved flow
8- Simplification of grinding
9- Improved stain removal
10- Improved gloss.

The disadvantages to be considered are:

1- The dry is slowed by the presence of the alkyds
2- There is a decrease in enamel holdout
3- The ultimate or long term scrub resistance is decreased.
4- Since the alkyds are generally supplied as a 100% solids plastic, there is some problem involved in incorporating the alkyd in the water system. This difficulty, however, is not too significant once the manufacturer has worked out a system.

Alkyds will have essentially the same good and bad effects when used with a copolymer emulsion such as "Arolon" 110. Bulletin formulas for this product show the use of over 10% modifying alkyd in floor paint formulas.

Alkyd Emulsions

Most of what is true about long oil alkyd modifiers is also true of the second category, alkyd emulsions. Really, the only reason for separation into two groups is the manner in which the products are marketed. Some companies sell alkyd solids, other sell alkyd emulsions. Those who sell alkyd emulsions, recommend them as latex modifiers and also as the only vehicle in various types of finishes. Use of alkyd emulsions as the sole vehicle for paints has had limited acceptance. This may change as more is learned of the performance characteristics of such emulsions.

Copolymer Emulsions

The third group consists of the copolymer emulsions in which the oil or alkyd component is an intimate part of the emulsion. This pretty well describes "Arolon" 110. This vehicle is characterized by extremely small particle size and excellent chemical and mechanical stability. An unpigmented film possesses excellent clarity, high gloss, and good flexibility, Because

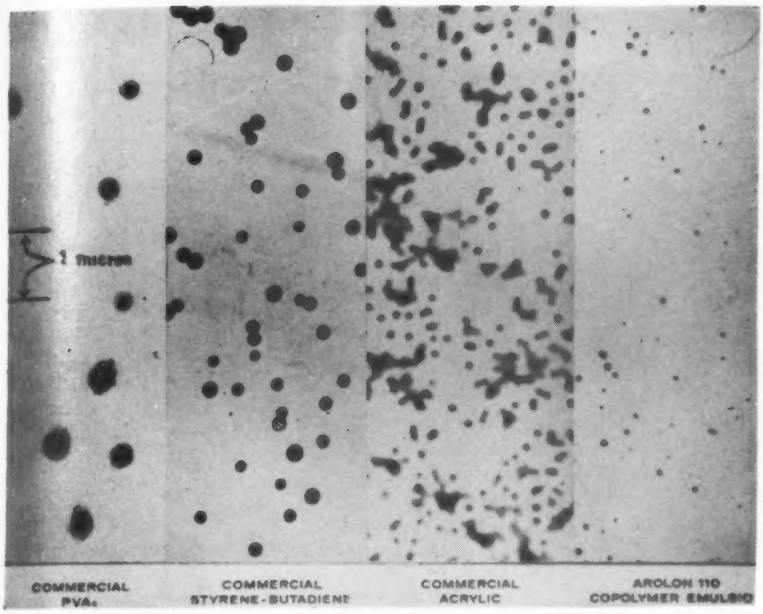

Figure 1. Electron photomicrograph of three commercial emulsions and Arolon 110. The average particle size of Arolon 110 is less than 0.1 microns.

of the oxidizing nature of the film—it does contain oil-based resin—it develops good adhesion and excellent water resistance. Paints based on this system have superior color acceptance with the different types of tinting systems. These paints are characterized by low odor, easy application and good color and sheen uniformity. Equipment is easily cleaned with water.

The small particle size of the solid portion of this emulsion makes it possible to formulate at PVC's higher than those possible with most other emulsions (Figure 1). Enamels can be formulated at 20 PVC (2.5 pounds of TiO_2 per gallon). A PVC in this range, which is necessary for good hiding in whites and light tints, still results in a 60 degree gloss of 90-95. Again, the small particle size permits a higher critical PVC in flat paints. This means higher quality flats for equal money. As suggested earlier, emulsion based concrete floor paints have been introduced during the last year. The copolymer emulsion has found good acceptance in this application. It possesses good adhesion, excellent resistance, and good abrasion resistance. The copolymer emulsions, in common with other emulsions, are being evaluated on exterior exposure.

It is now possible to make aluminum paints with all varieties of emulsions, a fete which was impossible a few years ago. A new type of aluminum pigment and patented procedure prevent bursting of these cans of water-thinned paint. (4)

A copolymer emulsion can be used as a modifier. Several paint manufacturers long accustomed to using styrene-butadiene find that a combination of this material and "Arolon" 110 (about 1:1) improves adhesion and color acceptance.

The fourth group, which is clear, homogeneous water-solubilized products, includes "Arolon" 304 and "Arolon" 1000 of the Arch-Daniels-Midland Company. As far as we know, these are the only members of the water-solubilized group available on a commercial scale. This will probably not long be the case. Other vehicle manufacturers already have experimental samples of homogenous water-thinned vehicles.

Advantages

There are a number of advantages for the water-soluble resin system:

1- Simplicity of formulation. Paint formulation using a water-soluble vehicle is similar to that using conventional solvent-thinned resins. The only ingredients necessary are pigment, vehicle, water, and in some cases drier. No pigment wetting agents, protective colloids, film coalescing agents, emulsifiers or similar modifiers required for latex systems are needed with the water-soluble resins. Since the formula does not contain any of these non-converting water-soluble modifiers, the vehcile converts to yield a water resistant film. The composition of an "Arolon" 304 primer shown in Formulation A demonstrates the simplicity of formulation.

2- Pigment dispersion. The usual type of pigment dispersing equipment can be used. Water-soluble vehicles often serve as excellent dispersing mediums. Compatibility of water-soluble resins with pigments is more critical than the pigment compatibility of solvent-cut resins. Each pigment should be carefully checked. Certain reactive pigments should be avoided.

3- Film conversion. Water-soluble vehicles may be designed

"Arolon" 304 Primer
Formula M-508

Lbs	Gals	
100	2.55	Iron Oxide
100	4.63	Magnesium Silicate
60	2.80	Aluminum Silicate
40	1.18	Strontium Chromate
350	41.00	Arolon 304
150	17.50	Arolon 304
2	0.25	6% Manganese
300	36.00	Water
1102	105.91	

Roller Mill Grind
PVC - - - - - - - 31.4%
Per cent Solids - - 46.8%
Lbs per Gal - - - - 10.42

Formulation A.

	Arolon 1000	Short Soya Alkyd + 12% Melamine	Short Coconut Alkyd + 30% Melamine
Flexibility 30′ 250°F	40%	60%	20%
Graham-Linton Hardness 30′ 250°F	500 g	500 g	450 g
Sward Hardness 30′ 250°F	18	14	20
Gloss			
Initial 30′ 250°F	92	91	91
Retention 2 hrs 300°F	82	78	85
Yellowness			
Initial 30′ 250°F	023	.030	.017
Retention 2 hrs 300°F	.050	.240	.024

Table 1. Film properties of enamels.

to give thermosetting type resins which will equal solvent systems in many film performance properties, such as salt spray and water resistance, hardness, toughness, and adhesion. Water-soluble systems have also been developed which convert to films by air drying. Table 1 shows a comparison of film properties of enamels (2.3 pounds ot titanium dioxide per gallon). Film flexibility was determined on the GE Impact Tester after a 30-minute bake at 250°F. The hardness, gloss, and color tests were run on films of equal thickness cast on glass plate and baked as indicated. The humidity resistance shown in Figure 2 was run on panels coated first with iron oxide primers followed by white enamels (2.3 pounds titanium dioxide per gallon). In this test a complete water system—"Arolon" 1000 topcoat over "Arolon" 304 primer—is compared to conventional solvent cut systems. The panels are bonderized steel, the primers and enamels were baked 30 minutes at 300°F. The test was conducted at 110°F and 100% condensing humidity for 16 days. The results indicate that the water soluble resin is in the same league as the top quality controls. Careful examination of the photograph will reveal small blisters on the two alkyd control panels. There are no signs of failure on the other panel. (Figure 2)

4- Film continuity. The paint system based on a water-soluble vehicle does not differ in film deposition and formation from solvent systems. Logically one might expect that any film cast from a water solution would be highly water sensitive. This is not necessarily so. Film integrity may be excellent as shown by the comparison of salt spray and water resistance of solvent and water-thinned resins shown in Figure 3. The panels were sprayed with one coat of M-508 primer formula shown earlier. The panels are bonderized steel with finishes baked 30 minutes at 300°F., film thickness 1.3 mils. Spray was 5% NaCl at 95°F. Water immersion was in distilled water at 75°F for 300 hours. After 500 hours salt spray there is no visible failure; at 750 hours the failure is not severe. There is no blistering on any portion of the panel and only slight rust creepage at the "X". After water immersion, no blistering or other signs of failure are noted. We have observed that these primers shed surface water much quicker than conventional alkyd primers. (Figure 3).

5- Pigment binding and gloss. These approach that obtained in solvent-thinned vehicle systems. The feature of direct pigment dispersion and wetting by the water-soluble vehicle provides for optimum performance. High gloss at pigment to binder ratios of 1:1 or greater can be realized.

6- Stability. Pigmented systems based on these resins can be dipped or sprayed and show no tendency toward skinning or clogging of spray equipment even after extended use. These paints can be frozen and thawed repeatedly without adverse effect. No preservatives are necessary and can corrosion is minimized.

"Arolon" 304 is a water-soluble air-drying and baking type vehicle. It may be used in either trade sales or industrial coatings which are not white or light tints. This product has been commercially available for about a year. It is being used in a variety of coatings in-

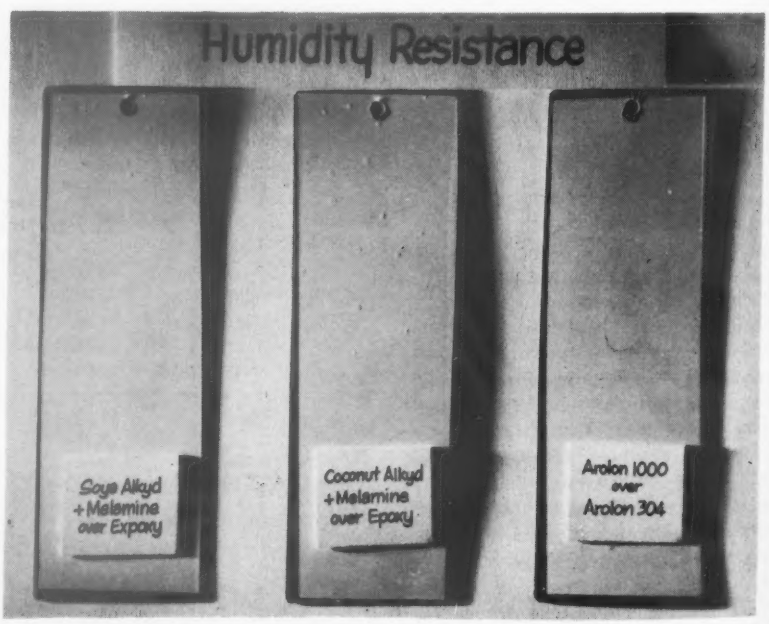

Figure 2. Humidity resistance of water-thinned system versus solvent systems.

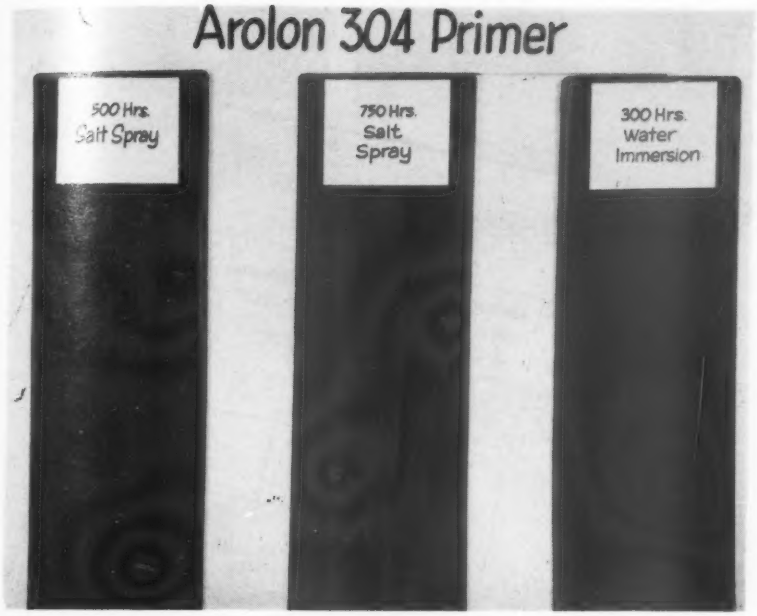

Figure 3. Water and salt spray resistance of water-thinned primers.

cluding floor paints, inks, and additives. One of its more important applications is in floor paint. It is used with styrene-butadiene latex (Dow Latex 762) to the extent of 25% of the vehicle solids. An interesting though not large volume use is in solvent-thinned paints which are to be tinted with water dispersed color systems. The presence of the water-soluble resin aids the dispersion of the tinting pigment. Another application is in baked primers. Figure 4 compares the results of using "Arolon" 304 iron oxide primer versus a short soya alkyd iron oxide primer under a white enamel. The cold rolled steel panels were given one spray coat of the primer, baked 30 minutes at 300°F. and later topcoated with a melamine modified alkyd enamel (2.3 pounds titanium dioxide per gallon). Cross hatched score marks were made down to the metal; the panels were exposed to 5% salt spray for 600 hours. (Figure 4)

The newest water-soluble resin, "Arolon" 1000, has been commercially available for about three months. It is light colored and has good gloss and color retention, which make it desirable for high quality white baking enamels. It is being used by some paint manufacturers already and being investigated by many others for a multiplicity of applications. A non-bake use for this vehicle has been found in printing inks.

As part of the Glycerine Producers' Association symposium entitled "Alkyds in Transition" the title suggested for this paper was "Water-Thinned Resins — Where They Stand." Well, they aren't standing at all — water-thinned vehicles of all sorts and kinds are moving into more and more coating applications just as fast as their technological legs will carry them. With anti-pollution regulations as a prod, and freedom from fire hazard as an added stimulus, the big stride is in the direction of industrial applications. We are far from the end of our search for new water-thinned vehicles. Many areas of research are being vigorously studied. We are looking for better weather durability. Light-colored air dry systems are needed for all types of architectural systems. Much application research is required before water-thinned paints can be applied as uniformly and consistently as their solvent-thinned brothers.

Water-thinned resins are still in their infancy. In a few short years products have reached the market place which have performance competitive with many of the solvent-thinned finishes. More remains to be learned, but already the technical performance of the existing water-thinned vehicles demands the attention of the paint manufacturer and promises more for the future.

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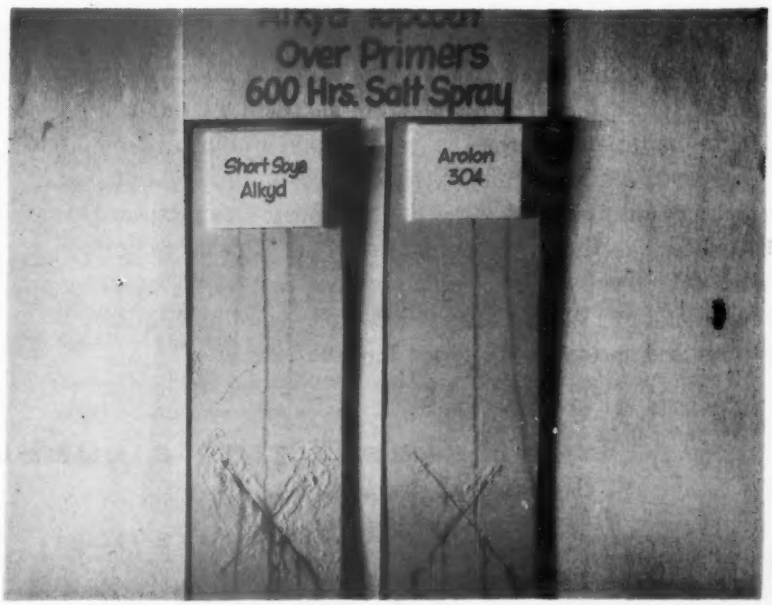
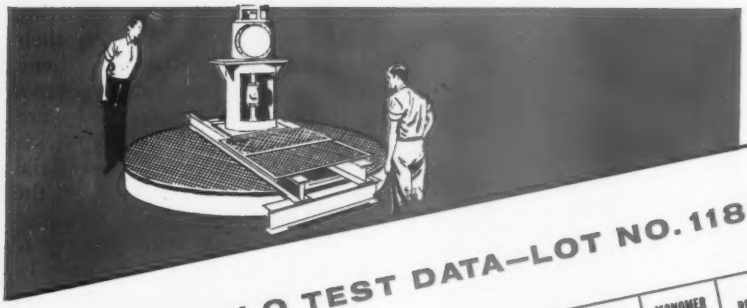


Figure 4. Automotive topcoat over solvent-thinned and water-thinned primers.



GEN-FLO TEST DATA—LOT NO. 1189—MN 58

TEST	SURFACE TENSION	Ph	% COAGULUM	VISCOSITY	FREEZE THAW	TOTAL SOLIDS CONTENT	MONOMER CHARGE RATIO	RESIDUAL STYRENE	SPECIFIC GRAVITY	MECHANICAL STABILITY	PARTICLE SIZE	
O. K.	✓	✓✓ ✓✓	✓	✓	✓	✓✓	✓	✓	✓	✓✓	✓	✓
FAIL												
INITIAL	JK	cm fmk ma St.V.	SK	me	BV	HP QP	DZ	DH	SP	JR MS	RK	CHA
DATE	10/15	10/15 10/15 10/15 10/15	10/15	10/15	10/15	10/15 10/15	10/15	10/15	10/15	10/15 10/15	10/15	10/15

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AMINO ALKYDS— THEIR FUTURE DEPENDS ON YOU

By
J. N. Butler*

ONE important segment of the alkyd resin market is that which requires performances that can not be attained by the alkyd resin alone. I am not speaking of the markets that can be fulfilled by modification of the alkyd with other components that the alkyd processor can do in his own kettles. Rather I refer to that which currently requires another type of resin, manufactured by only a few of the alkyd producers, which must be combined with the finished alkyd to upgrade the alkyd properties for satisfactory performance. Of course, the amino resins do just that—and do it well, where increased hardness, improved gloss and color retention, better durability and chemical resistance are required. Generally speaking, amino resins have applications wherever a coating can be baked regardless of the substrate on which such finishes are to be applied. However, a majority of these applications are confined to metal coatings, and to wood finishes where the cure can be catalyzed and forced dried at relatively low temperatures. Other specialized applications include certain textile and paper coatings. In any event, their successful use requires blending them with other resins capable of interaction with the amino resin. From the variety of resins containing hydroxyl groups, ether groups or ester groups, alkyd resins of various types have been the most widely used. The combination of alkyd and amino resin provides either an efficient, low-cost, reactive plasticizer for the amino resin, or a means of providing rapid heat convertibility for the alkyd resin.

*Senior Sales Engineer, Monsanto Chemical Co.

Properties of Amino Resin

Rather sharp differences exist in the performance of melamine and urea resins in combination with alkyd resins. Melamines are generally noted for (1) Much faster cure; (2) Much better color retention and gloss retention on over-baking; (3) Much better soap and alkali resistance; (4) Less film shrinkage on curing; (5) Better initial gloss and flow; (6) Much wider baking ranges; and (7) Better exterior durability. In comparison, the ureas are characterized by (1) Lower cost on pound-for-pound basis of solids; (2) Can be used with acid catalyst at low temperature; (3) Better adhesion; (4) Easier patching; (5) Better for undercoating; and (6) Yields higher viscosity enamel at equal solids content. Each of these amino resins have their place, and performance requirements dictate their use.

In spite of the many problems that were encountered in the development of alkyd-amino combinations, melamine–alkyd resin combinations in baking finishes have made spectacular progress in the past twenty years. It was just about this many years ago when melamine-formaldehyde resins be-

came commercially known, although melamine itself was first prepared in 1834. Melamine-formaldehyde resins are not due all the credit however, since alkyd resin compositions have changed significantly during this same twenty years to better compliment the amino resins. Importance of choice of oil length, type of oil, viscosity and acid value were soon recognized and close cooperation between alkyd producers and amino resin producers advanced the technology rapidly. Urea-formaldehyde coating resins have a similar history and represent a significant portion of the amino-alkyd coatings market.

Alkyd Growth

Let's look at the growth of the alkyd market. From 1949 to 1955 (a peak year), total phthalic alkyd production rose better than 70%, from 263 million pounds to 456 million pounds. In 1957, the figure was slightly below at 434 million pounds, indicating a plateauing of alkyd consumption. This has come about as a result of the increase in water-based coatings principally for architectural uses. This, indeed, has caused the alkyd producers considerable concern because, largely, the alkyd producers are not basic in the types of water-based vehicles that have found the greatest use. In the past year or two, however, progress has been made in putting alkyd resins into water for architectural coatings. Further development and use of this type vehicle will undoubtedly come about before any significant use of water-based alkyds for industrial applications is attained. Three things appear to substantiate this: (1) Water-based alkyds will logically be aimed at that market where the styrene-butadienes, polyvinyl acetates and acrylics now enjoy such a healthy use; (2) Longer oil alkyds are easier to combine with water; and (3) Interior architectural performance requirements are less stringent than those of industrial applications.

Amino Growth

What has been the growth of melamine and urea resins for protective coatings since 1949? Melamine and urea resins combined double from 18 million in 1949, to 37 million pounds in 1957. Assuming these amino resins were combined with alkyds in the ratio of 20 pounds of amino resin to 80 pounds of alkyd, then 34% of the total alkyds produced in 1957 were combined with melamine and urea resins. In 1949, this figure was 27% on the same basis. When comparing these percentages, the decrease in growth of alkyds at the expense of water-based paints must be considered. Whether this growth of amino resins continues depends, to a large degree, on the ingenuity of the alkyd and amino resin designer and those supporting him. A good example of this is the progress made in the performance of automotive coatings such as used on Ford and Chrysler products. As lighter, pastel shades in multiple colors for top coats became popular, color and gloss retention on overbake was an obstacle that has largely been overcome through redesign of the alkyd and increased amino resin content. Today, this system is probably the best on overall performance and lower in raw material and application cost than any in use.

Safety Factor

Possibly the greatest demand for a change in the present type industrial coatings is for safety reasons. Flammable solvents have been looked upon with considerable concern by finishers of mass-produced items, particularly the automotive manufacturers. Water-based coatings are believed by most to be the answer because water is non-flammable, and also because water-based coatings have been successfully produced for architectural uses. A number of companies in the surface coatings industry are working on water-based coatings for industrial applications and some have been introduced. This is a great step in moving the technology forward. The surface is hardly scratched, however, and the alkyd resin producers should intensify their research efforts to put alkyds in water. Water-based amino resins should also be developed to fit the alkyd. During the next few years, this is probably the surest way of getting the most out of your investment in alkyd facilities. The economics are on your side and this is a sound reason for putting more effort into alkyd research.

To show the confidence the alkyd manufacturers have in the future of alkyd resins, nearly 50 thousand gallons of new kettle capacity have been installed by alkyd producers since 1956 with an additional 15 thousand gallons of capacity being currently installed. Another vote of confidence for the future of alkyds is the number of producing points where molten handling of phthalic anhydride has been instituted. There are a dozen plants which have installed these facilities during the past two to three years with others in the planning stages.

Another means of overcoming the safety hazard of flammable solvents is with a 100% solids vehicle. Little work has been reported along this line of attempting to build a polmer of suitable molecular weight that is workable without dilution. Other new systems and combinations are forthcoming, some of which are being discussed at this symposium.

Future of the present day amino-alkyd systems will be hampered by some of the newer type of industrial finishes. I cite the thermosetting acrylics as one type. Even so, they should about hold their own with growth proportional to the economy of the country. Recently, reports have stated that several resin producers, as well as resin raw material suppliers, are expending considerable research effort in the field of water-based coating materials. Some of these are reported to be based on alkyd resins. Any newcomers will help to speed up the technological advances necessary for continued growth of the alkyd industry. Monsanto definitely is researching in this direction, both from the standpoint of the alkyd resin as well as the amino resins.

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By
T. Mika*

ONE of the important uses for epoxy resins is in the preparation of fatty acid esters. In this end-use both the epoxide and hydroxyl functionalities of these resins are utilized as resinous polyols. The epoxy resin esters are characterized by excellent physical and chemical resistance properties. The conventional alkyd resins in turn show good resistance to weathering and yellowing; however, they are somewhat lacking in the properties noted for epoxy resin esters. In conventional systems, attempts to combine the useful properties of both alkyd resin and epoxy resin esters are functionality limiting because the most desirable esters of epoxy resins are derived from grades having an esterifiable functionality of 6 to 13 per mole. Somerville and Herr[1] have proposed a "defunctionalization" technique for the utilization of epoxy resins in practical modified alkyd systems. Their defunctionalization technique involved the formation of a partial ester of the epoxy resin, generally to give three remaining esterifiable groups, and the use of this polymeric polyol in a glycerol-phthalic alkyd.

This paper is an extension of the work reported by Somerville and Herr with specific emphasis to the study of the mechanical and chemical properties of the free films prepared from the epoxy resin modified alkyd resins. Unsupported films from these systems, 1.5 to 3 mils thick, were examined for stress-strain properties via the Instron tester after various cure cycles and limited periods of accelerated aging.

A partial fatty acid ester of "Epon" Resin 1004,[2] esterified to retain an average of 3 unreacted hydroxyl groups, was used to the extent of one-quarter mole in a modified alkyd, the remainder consisting of 1 mole phthalic anhydride, 1 mole of fatty acid, and three-quarter moles of glycerol. This modified alkyd, containing 50% fatty acid, was cooked by the solvent reflux technique to an acid value of 7. Formulation of this system is given in Table 1.

Stress-Strain Properties

The stress-strain properties of this modified alkyd based on soya acids in comparison to a laboratory-prepared unmodified alkyd and a commercial soya alkyd of the same oil length (50%) are illustrated in Figure 1. In this figure, the open stars represent films air-dried two weeks in a constant temperature room (77°F and 55% relative humidity), the partially closed stars after two months of similar aging, and the completely closed stars after one year of normal room aging. All systems aged as unsupported films. The diamonds on the right illustrate elongation. Here, the completely closed diamonds

	No. of Moles	Mol Wt	Wt	Wt %	
Phthalic Anhydride	1	148	148	15.3	
Fatty Acids	1	202	202	20.8	20.8
Defunctionalized "Epon" 1004	0.25	2224	556	57.2	
48% "Epon" Resin 1004 (1 mole)					
52% Fatty Acids (4.75 moles)					29.8
Glycerol	0.75	92	169	6.7	
			971	100.0	
			% Fatty Acids		50.6

Table 1. Epoxy modified alkyd.

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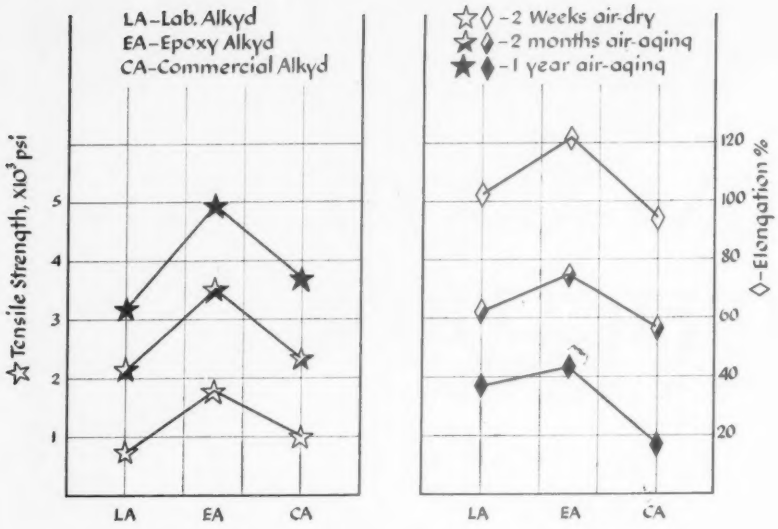

Figure 1. Stress-strain properties of alkyds and epoxy-alkyds.

1. Film after 2 months air-aging
2. Film after 50 hours in Weatherometer
3. Film after 10 hours at 100°C.

Figure 2. Instron stress-strain curves at various exposures.

represent the two-week aged film, the partially closed diamonds two-month aged films, and the open diamonds one-year aged films.

Interestingly, the laboratory-prepared alkyd showed by analysis 14.5% unreacted hydroxyls whereas the commercial alkyd showed an analysis of 8.8% unreacted hydroxyls. The epoxy modified alkyd has 10.3% unreacted hydroxyls. The differences between the laboratory-prepared and the commercial alkyds can undoubtedly, to a good measure, he accounted for by the differences in hydroxyl content. However, the differences in the stress-strain properties of the epoxy-modified alkyd and the unmodified alkyds must be chiefly attributed to differences in chemical structure, particularly greater molecular complexity, bearing in mind that the defunctionalized "Epon" ester going into the alkyd has an initial calculated molecular weight of 2200.

In applying the Instron to the study of these films it was observed that early degradation under accelerated aging was characterized by the development of a yield value. This early degradation was not always obvious from stress-strain measurements alone.

Figure 2 illustrates this point. These are a series of stress-strain curves as plotted on the strip chart from the recording section of the Instron tester (0.5″/min speed). This figure illustrates development of a yield value of a 50% soya alkyd after various exposures.

Resistance to degradation was also readily adaptable to expression as Young's Modulus, stress required to produce a given strain within the elastic limits. The Young's Modulus was calculated from the tangent to the stress-strain curve which is made as a continuous plot of the Instron.

Figure 3 illustrates Young's Modulus. The left section of this figure is a 50% soya acids epoxy modified alkyd after two weeks air-aging as 1, after ten hours at 100°C as 2, after 25 hours in the Fadeometer as 3, and after 50 hours in the Weatherometer as 4. The right section is a 50% soya acid lab-prepared alkyd after the same aging periods.

As with unmodified alkyds, the epoxy modified alkyds can be varied in properties at any one oil length by changing the type of fatty acids used for esterification. In order to determine the effect of fatty acid types on epoxy modified alkyds, three alkyds were prepared based on soya acids, linseed and dehydrated castor acids. These alkyds were based on Epon 1004 at a 40% total fatty acid content all prepared by solvent cooking techniques to an acid value of 4. Stress-strain curves of these systems are illustrated in Figure 4. As has been previously demonstrated by similar work on straight epoxy resin esters, air-dried films (after two weeks' dry)—represented as open circles—were weaker but more flexible (flexibility represented as open squares) for soya but essentially similar for both linseed and D. C. O. acids. The same relationship held for films after one-hour bake at 100°C (here represented as partially shaded circles and squares). However, after accelerated weathering,

(*Turn to page 113*)

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TRIMELLITIC ANHYDRIDE— A NEW ALKYD RAW MATERIAL

By
J. R. Eiszner
R. S. Taylor
B. A. Bolton

SINCE the introduction of alkyd resins during the late 1920's, their consumption has grown rapidly and they now have a position as the dominant resins used in protective coatings. Technological progress has been responsible for a substantial portion of this growth. Resin chemists have learned new techniques of formulating and processing alkyds. However, we must also recognize that the development of new products for use in the production of these resins has made a significant contribution.

This development of new materials has been primarily in the drying oil and acid, polyol and aliphatic acid fields. Only in the past few years have new aromatic acids begun to be developed as replacements for, or modifiers of, phthalic anhydride, the original aromatic acid employed. The first of these was isophthalic acid. It promised certain advantages over phthalic anhydride and is presently gaining commercial acceptance.

Now, Amoco Chemicals is introducing trimellitic anhydride as another new aromatic acid for use in alkyd resin formulation. Trimellitic anhydride, shown in Figure 1, is the anhydride of 1,2,4-benzene tricarboxylic acid. It is a white solid melting at 168°C-334°F. It is potentially available at a price which should be attractive to alkyd resin producers.

Trimellitic is now available in development quantities; however, we foresee semi-works production in the future to make larger quantities available to our customers for their plant testing. Our timing will be largely determined by the desires of the coatings industry and others. I say others because trimellitic has possible uses in polyesters, dyes, plasticizers, epoxy curing and as a chemical intermediate.

The introduction of trimellitic anhydride is one step in a succession of new aromatic acid developments. Amoco Chemicals' new oxidation process promises that there will be other new aromatic acids commercially available in the years to come. In fact, we hope to have others following on the heels of trimellitic next year. These aromatic acids, like the other new alkyd raw materials which have been introduced during the past 20 or 30 years, promise to broaden still further the fields of application of alkyds; assisting them to compete more effectively with other resins now being introduced by enabling the formulator to obtain properties which cannot be obtained with either phthalic anhydride or isophthalic acid.

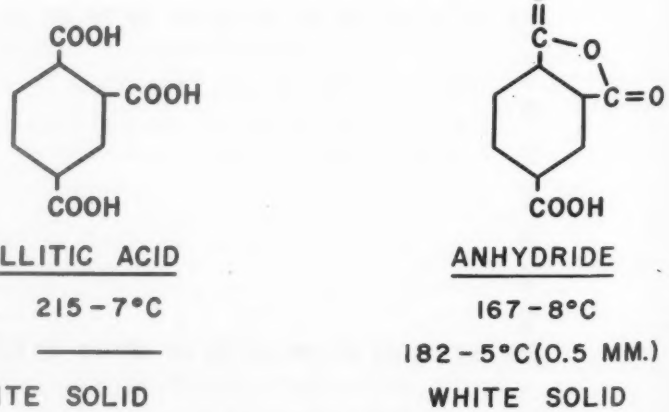

Figure 1. Chemical structure of trimellitic acid and anhydride.

The authors of this paper are associated with Amoco Chemicals, Inc.

Amoco Chemicals research has developed alkyd formulations employing the new trifunctional acid-trimellitic anhydride. Certain formulations have been developed illustrating its use as a replacement for, or a modifier of, phthalic anhydride. Because of the additional functionality offered by trimellitic anhydride, it is possible to formulate very long oil alkyds which have excellent properties. Unmodified drying oil alkyds, containing only oil, glycerine and trimellitic anhydride, can be processed at oil lengths of about 77 percent or higher using conventional techniques. The resins obtained have a conventional polyol excess, acid number and viscosity.

The properties of a 79 percent linseed, glycerol, trimellitic alkyd are shown in Figure 2. This resin is composed of 156 parts by weight of trimellitic, 756 parts of linseed oil, and 80 parts of glycerine. The resin is prepared by conventional processing techniques, but at a slightly lower temperature, 400°F, for 6 to 8 hours. The reaction can be carried out either as a fusion or as a solvent cook.

The resin properties are considerably different from those which would be obtained with either a phthalic anhydride or isophthalic resin at this oil length. The vehicle, with a 12½ excess of polyol, has a viscosity of R-S at 60 percent solids in mineral spirits. It has a color of 4-6 and an acid number of about five. Perhaps the most distinguishing characteristics of this resin are its fast drying rate, and relatively high hardness for a resin containing this high percentage of oil.

Films of the resin dry Kraft paper free in 2½ to 3½ hours as shown in Figure 3. They have a seven day Sward hardness of around 12. Paints, formulated in an exterior-interior enamel formulation, dry Kraft paper free in about 3¾ to 4 hours and have a seven day hardness of about 14, slowly increasing to about 16. The film properties in general seem to be excellent in the tests completed thus far.

We have great hopes for the commercial utility of enamels formulated from vehicles such as this. We still do not have long term data on the exterior weathering characteristics of this resin: we have had panels out for about 6 to 8 months. However, a paint from a 77 percent soya oil resin, which we formulated earlier, has been exposed for over two years. A similarly pigmented type TTR 266A soybean, pentaerythritol, phthalic alkyd was exposed at the same time as a control. The trimellitic paint is holding up as well with slightly better gloss retention after this two year exposure.

Going toward longer oil lengths, we have formulated a 90 percent soya, pentaerythritol, trimellitic alkyd which seems to have very excellent possibilities in outside house paints. It also looks promising as a printing ink vehicle.

Summing up our remarks on the use of trimellitic anhydride as a replacement for, or modifier of, phthalic anhydride; we can say that our results indicate that the major effect of this replacement normally is an increase in hardness at a given oil length, and a decrease in drying time. Use of trimellitic anhydride in this way will probably offer the alkyd producer an opportunity to make improved quality products. It may not do a great deal to extend the applications of alkyd resins.

We feel that the use of trimellitic anhydride as a completely novel type of material will do a much better job of extending the scope of alkyd resins, rather than merely plugging it in to existing alkyd technology. It is better to take maximum advantage of the third carboxyl group and to use it as a handle in order to impart specific characteristics to a resin. For example, we have prepared various alkyds containing no vegetable oils of fatty acids. One of these resins is prepared by opening the anhydride ring of trimellitic anhydride with an alcohol. The product is still a dibasic acid capable of polyesterification with glycols. Different alcohols offer different properties. For example, isobutyl alcohol can be used for a hard finish or, if a softer film is desired, isooctyl alcohol can be employed.

A resin from isobutanol, trimellitic and a mixture of diethylene and butylene glycols, cooked to an acid number of 10 to 13, has a viscosity of S to T at 50 percent solids in xylol. A Gardner color of 2 can be obtained. The resin will bake out at 300°F in 30 minutes when modified with 15 percent melamine resin to a film with a Sward hardness of approximately 35. This film will pass a 1/8th inch mandrel bend, and is useful as an industrial baking finish.

79% LINSEED – GLYCEROL VEHICLE

12.5% Excess Polyol

VISCOSITY	R-S (60% SOLIDS – M.S.)
COLOR	4 – 6
ACID NO.	ABOUT 5

Figure 2. Properties of oil modified trimellitic alkyd.

79% LINSEED – GLYCEROL VEHICLE

FILM PROPERTIES – 1 MIL. DRY-CLEAR

DRYING RATE: (HOURS)

SET TO TOUCH :	1 – 1½
SET TO COTTON:	2
KRAFT PAPER FREE:	2½ – 3½

SWARD HARDNESS (7 DAY): 12

Figure 3. Film properties of oil modified trimellitic alkyd.

ZERO OIL TRIMELLITIC ALKYD (ADIPIC ACID MODIFIED)	
46%	TRIMELLITIC ANHYDRIDE
12%	ADIPIC ACID
42%	PROPYLENE GLYCOL
PROCESSING TEMP.	350°F.
PROCESSING TIME	7-8 HRS.
ACID VALUE	ABOUT 50

Figure 4. Formulation of straight trimellitic alkyd.

ZERO OIL TRIMELLITIC ALKYD (ADIPIC ACID MODIFIED)	
BAKING SCHEDULE	25 MIN. AT 400F.
SWARD HARDNESS	40-50
FLEXIBILITY	PASS 1/8" BEND
IMPACT RESISTANCE	> 80 IN.-LBS.

Figure 5. Properties of straight trimellitic alkyd.

The most recent work we have done in capitalizing on the third carboxyl group of trimellitic anhydride is to prepare resins which are water soluble and have properties that surpass previously known water based coatings. These resins are made from trimellitic, a dibasic aliphatic acid and a simple glycol or a glycol obtained by esterifying a higher polyol with a monobasic acid.

Figure 4 shows a resin prepared from 459 parts of trimellitic anhydride, 116 of adipic acid and 425 parts of propylene glycol. The resin is cooked at a temperature considerably lower than is normally used for alkyd cooking. All raw materials are charged together, and then the resin is cooked at 350°F for about seven or eight hours, until an acid number of 45 to 50 is obtained. At this point, the resin can be cooled and reduced in either of two ways. If a solvent solution of the resin is desired, reduction can be accomplished with a mixture of about 60 percent xylol and 40 percent butanol.

However, if a water soluble resin is desired, it can be obtained by reducing the resin in an ammoniacal solution containing just enough ammonia to neutralize the acid groups on the polymer. This is indicated, of course, by the acid number. The resultant water solution is odorless. It is slightly on the acid side with a pH of around six to seven and is infinitely reducible, or miscible, with water. The next slide shows properties that can be obtained from either the solvent or the water solution. Both systems give the same properties. They both require a baking schedule of 25 minutes at 400°F. They give films with high gloss, comparable to conventional industrial alkyds; they show color retention which is outstanding—there is virtually no change in white enamels after 16 hours overbake at 400° and some have been baked as long as 32 hours with essentially no color development. The films are very hard, depending on which glycols or diols are used—hardnesses have ranged from 40 to 50 Sward. The films are flexible—passing a 1/8th inch mandrel. They have good impact resistance; some are greater than 80 inch pounds. They are outstanding in resistance to boiling water; they have good salt spray resistance, good adhesion to both steel and aluminum and they are very resistant to marring.

We have a series of pictures showing the results of some comparative testing we have done on these resins. Figure 6 illustrates the water resistance typical of these resins prepared from trimellitic. The films were baked on aluminum panels. On the left is a neopentyl glycol derived resin-baked from a water solution, next to it is a similar resin from the xylol-butanol solvent system, the third panel is a commercial coconut oil alkyd modified with 30 percent melamine resin, and on the far right is a silicone modified alkyd. The panels were partially immersed in boiling water for 16 hours. As you can see the new trimellitic resins held up very well, while both of the other coatings deteriorated. There is little or no difference in the performance of the trimellitic resin whether the film is deposited from water or solvent.

The next group are pictures of some paints taken before and after 16 hour overbakes at 400°F. The pigmentation in each case was 0.9 parts of titanium dioxide to one of resin except for one purchased commercial enamel.

The vehicle in Figure 7 is the propylene glycol-trimellitic-adipic resin dissolved in water. As you see the initial color is good and very little color develops after overbaking. There was only a moderate decrease in gloss. Figure 8 shows a neopentyl glycol derived resin and here color retention is even better—there is essentially no darkening or yellowing of the film. Gloss retention was also better than with the propylene glycol resin. For contrast, Figure 9 shows a purchased, high quality, appliance enamel. This is the type resin used for color retentive

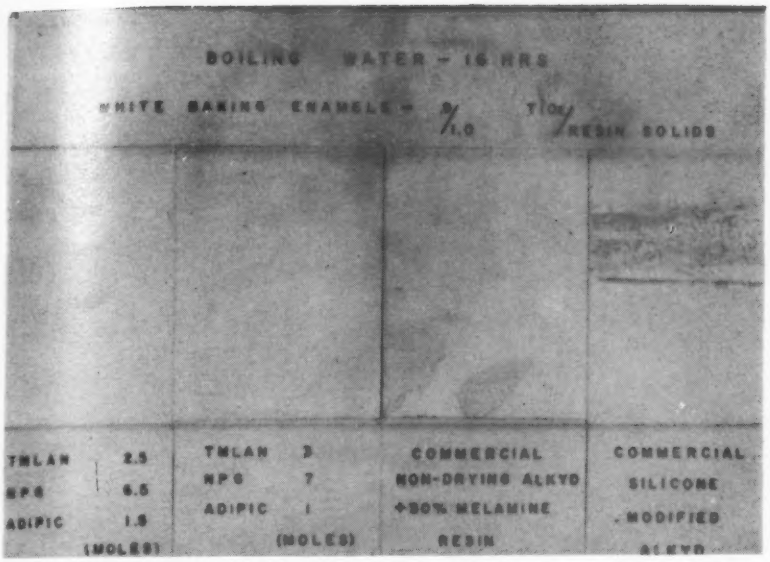

Figure 6. Water resistance of various trimellitic alkyds vs. a commercial alkyd.

whites. Extensive darkening of the film has occurred and no gloss remains.

The good salt spray resistance on steel is illustrated in Figure 10. All of these salt spray data were obtained on panels scored with an H, using the tape-pull method on the right-hand side. The panels are removed from the cabinet daily, a piece of masking tape is rolled firmly over the right-hand, vertical score line. The tape is then jerked from the panel and the panel replaced in the salt spray cabinet for another 24 hour period. Here an acrylic lacquer and a melamine modified coconut alkyd have failed completely where the tape has been employed, and the other portion of the H shows considerable corrosion creepage, while the propylene glycol-trimellitic resin from a solvent and the neopentyl-trimellitic resin from water have held up very well after 200 hours exposure.

Figure 11 shows some comparative salt spray test results on aluminum. On the left, the melamine modified coconut alkyd has failed where it was taped; the neopentyl glycol-trimellitic resin from solvent and from water, and a 1,3-butylene glycol-trimellitic resin from water all held up very well.

Although these water soluble resins have many advantages to offer, we realize that there are some problems to be solved, prior to their commercial use. In the first place, the film requires a full 25 minutes baking at 400° to obtain a satisfactory cure. Many baking lines do not have ovens capable of obtaining this temperature. Furthermore, the trend has certainly been toward shorter baking times at lower temperatures.

We are searching for ways to reduce our baking schedule to meet this commercial requirement.

We are also trying to improve other problems which have been apparent. The films of these resins

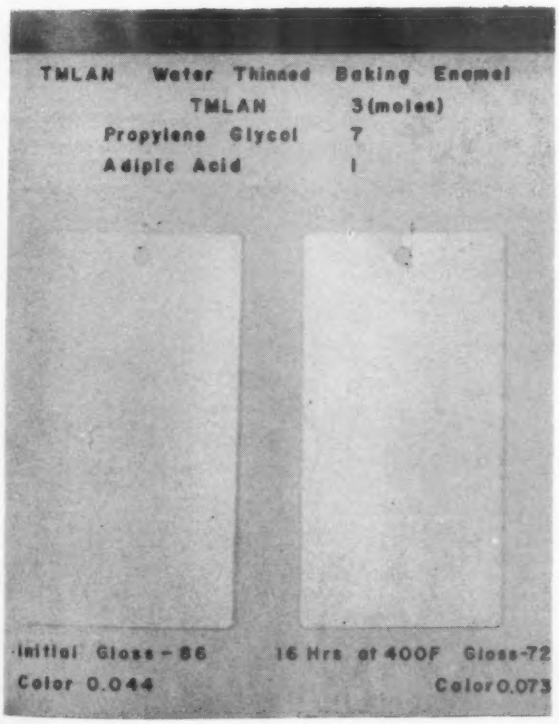

Figure 7. Gloss properties of water-soluble propylene glycol-trimellitic-adipic resin.

Figure 8. Gloss properties of water-soluble neopentyl glycol-trimellitic-adipic resin.

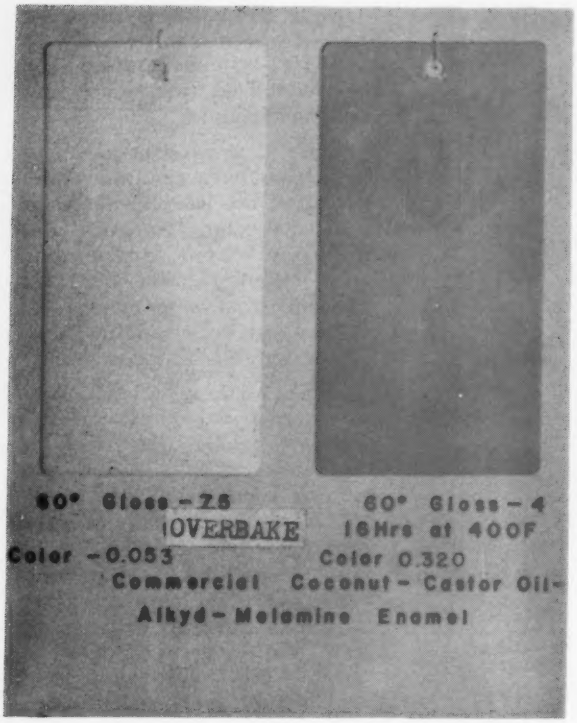

Figure 9. Gloss properties of propylene glycol-trimellitic-adipic resin vs. commercial coconut-castor oil alkyd-melamine enamel.

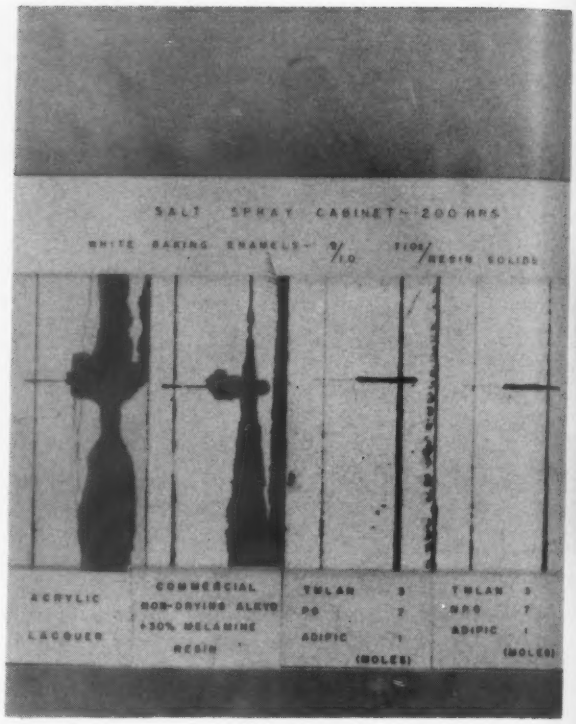

Figure 10. Comparison of salt-spray resistance of trimellitic alkyd vs. acrylic lacquer and a commercial alkyd.

tend to crater or pinhole. This does not occur consistently and varies somewhat with the glycol that is used in the formulation. We have also encountered a variation in the alkali resistance depending on the particular diol used; some of the resins are not as good as the melamine modified, industrial alkyds.

There are a large number of glycols or modified polyols which can be used to produce these resins. We have observed other differences in the resins prepared from them. For example, we have observed consistently that better gloss retention is observed in the Weatherometer with those resins which are prepared from neopentyl glycol. Marginally better color retention on extended overbaking is obtained with either neopentyl glycol or 1,3-butylene glycol derived resins. The diol prepared from one mole of trimethylolethane and one mole of benzoic acid has been tested and we have preliminary indications of an outstanding improvement in alkali resistance over the glycol type resins. We have also initiated some work using vegetable oil fatty acids to modify trifunctional and tetrafunctional polyols but no results are available at this time.

As you can see, trimellitic anhydride offers many new approaches to the coatings chemist. Resins from this new raw material are being explored extensively by Amoco Chemicals and by our potential customers. We think that the results obtained with trimellitic indicate some of the opportunities opened to alkyd resin formulators by the increasing availability of new aromatic acids.

Alkyd resins will certainly continue to improve; and the development of new raw materials—aromatic acids, polyols and drying oil components—will certainly have a great deal to do with this progress.

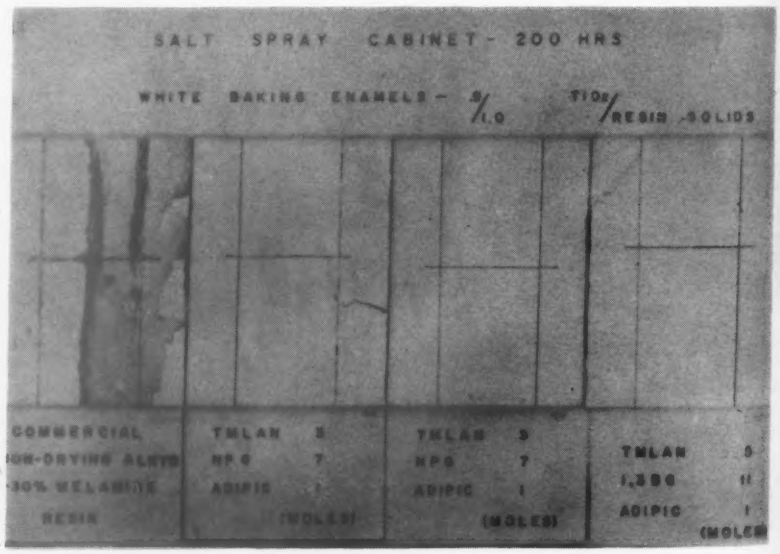

Figure 11. Comparison of salt-spray resistance of three trimellitic alkyds vs. a commercial alkyd.

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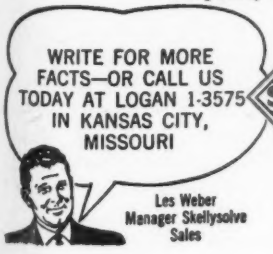

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RESEARCH NEEDS THAT LIE AHEAD

By
Dr. J. Scott Long*

I WANT to start with a little platitude that has nothing to do with what I have written on paper here and that is that the comfortable age of the world is gone—in anything. You don't have to be just at the luncheon here today to hear about space travel and things of that kind to feel that we should not be comfortable, but I think that in the paint and varnish business especially, we must realize that the age of comfort is pretty well gone and that from now on, we must live a more elastic life, if you want to call it that, certainly a more strenuous life, and not feel too comfortable about it.

That applies, of course, to this particular industry and the meeting of today.

Glycerine and fatty acids were produced many years ago from fats, with one idea at any rate, of using both of them in the paint and varnish industry. They split them up and then sold them to us separately at a higher price and this made some sense.

All right, that's been going on nicely, until recently, when it was somewhat threatened, and one of the problems we face today—I know I thought about it seriously before coming to the meeting—what is the future of alkyds from now on, or say, ten years from now? Next year, there is no question, they will be all right, but how about ten years from now, what's the future of alkyds?

Are we going to take fatty acids and glycerine and put them together with dibasic acids and anhydrides or the trimellitic and things of that kind and still have alkyds? Are they still going to hold against these copolymers which have a carbon, carbon, carbon, carbon spine and things hanging off of it? When you go back to either the polymers or copolymers, essentially what you are doing is saying, that you have a spine like a fish has, but changes in the carbon atoms that are not going to break.

If you are going to get conditions that change the carbon-carbon linkage, then none of this stuff is any good. When you get up to some of the temperatures that they want, none of our organic coatings are going to do it. But certainly, the most stable thing we have is the carbon, carbon, carbon linkage along, what I call, the spine of the molecule, from which hang the interesting groups.

That's the threat, those are the things that are coming in and essentially the thing that the alkyds do not have, which these other things have, is resistance to hydrolysis as at present constituted. Now, that's important—as at present constituted.

Well, have we exhausted the possibilities? I think not. I'll start with a few perfectly simple practical ones and then go to some that are much more visionary. Let's start with a couple of practical ones.

If you make alkyds, for some reason or other, all of you seem to feel that the mere fact that the foreman on the job says that the acid value and the vicosity has now passed the laboratory, so he's going to dump the kettle. He then passes this thing along and you pass it as if everything was all finished to the limit.

Well, there aren't many other industries that feel that way. In the steel industry, they don't pour the stuff out of a blast furnace and say, boy, there it is, take it away. All iron oxide is reduced to iron and the slag is floating on the top and we'll separate it. Here's the iron, boys, take it away. You have a lot or carbon, silicon, manganese, phosphorous, sulphur and so forth in it, but that's it. He's got to take it. Which you do! Chemists, very good chemists become so com-

This paper is based on a tape recording of Dr. Long's talk delivered at this symposium.

*Executive Director, Paint Research Institute.

placent—which is why I started out by saying the age of complacency is a thing of the past.

All of you say the mere fact that that stuff is dumped out of that kettle, that's it. I'm delighted that several of these men touced on the fact that an alkyd resin at that stage can be treated with modfying groups such as epoxy groups and others, which will react with OH's, carboxyl or anything else. This will remove the "trashy" stuff that's still left there, and in so doing, will give better alkyds.

We're all aware of the fact that in the emulsion type of paints, one of the weaknesses is the fact that surrounding all the little droplets of resin are emulsifying agents, protective colloids, things to preserve them. If you remember some of the original paints that were high in casein, it took pretty nearly as much preservative as it did casein to keep the paint from getting into trouble.

We don't have quite that much, but we've got an awful lot of what I'd call "trash" in the emulsion paints that you—unless we improve on this, are elements of weakness.

All right, we don't absolutely have to have those elements of weakness, certainly not in alkyd resins, unless we are going to emulsify them with water. The clean up of the residual carboxy and hydroxy groups (the resins have both of them simultaneously in many cases) offers considerable possibilities.

Here's another point, and I have been talking about this before, is that an alkyd resin, when it comes out of the kettle, is not finished. You are going to grind in some pigment and most cases, disperse it, to use the exact word. You are going to put it in cans and sell it to some painter, and some woman is going to smear it on the surface and then it is going to oxidize accidentally in the air, depending on whether there is any air in the room and how much moisture and one thing and another. You leave it entirely to chance.

All right, why do that? Why not oxidize the "stuff" before you put it in the can? Now, this can be done. It takes problems. But let's say you take an alkyd resin and you proceed, you've got fatty acids, unsaturated fatty acids hitched on there; you are not going to oxidize the phthalic. I am not advising you go to high temperatures. But at relatively low temperatures, you can oxidize ethylene linkages (double bonds). You know that! I'm not telling you anything new. We haven't been doing it.

Now, you can oxidize by blowing air through the material. This blowing air through it made me a fortune. Just blow air through—the A-D-M man knows this right now. He paid me royalties for it for many years, 17 full years.

All right, you blow air through an alkyd resin, not an oil. But you can't do it with 50 percent solid in it, it'll take you a year, depending on the temperature used and the lack of solvent or the minimum solvent that you can oxidize an alkyd. What happens when you oxidize an alkyd. Well, you can keep on going for a long way, as you oxidize it and put on polar groups. I don't need to tell you, you already know it—you improve the flow, the leveling, the speed of dry, and get rid of the induction period. You do lose solubility. There's nothing that I know of that's perfect in the world, none of the properties are bad and all of them good—you're not perfect. Sometimes I think I'm not perfect myself.

But you come along, and as you oxidize these alkyds, you are not going to be able to dissolve them in mineral spirits. We are going to grant that right away. The solubility in mineral spirits will become very small indeed. So, call that a defect in the emulsion type of system—that wouldn't even be a defect, it would be an asset.

But in any event, there will be changes occurring. And last, but not least, in the case of the oil, when we oxidized it, we gain weight 8 percent over all, and that's awful cheap. You can do an awful lot of blowing with an air compressor to get 8 percent.

You start with 100 pounds of oil and sell 108, the economics are on our side. In the case of alkyds, it won't be 8, it will be more nearly 4. Let's say we are talking about a 50 percent modified alkyd, you are only going to gain 4 percent, but that's about all you make and there's the profit to your company. You are doing pretty good it you wind up at the end of the year with 4. What I am talking about is the difference between profit and loss.

I have a civil engineer who is writing for me. As some of you probably know, I'm going to Edinburgh in the Spring to red a paper—and this paper is broken up into sections, and one of the sections deals with strains, forces and interfaces. Forces and interfaces—you don't think about them enough, and it includes the pigment interfaces too, both the upper and lower interfaces.

All right, the forces and interfaces involve not just the applied forces that you subject them to by pulling them or the forces of expansion and contraction(summer or winter) on a film on a surface in the open air, but the forces that are created automatically as the film dries. They are there, they are hidden, you don't see them, but the film doesn't know that. It only knows the total force that you put on in the drying process plus those you apply later—the swelling forces that take up moisture. All these go together and the film only knows the total thing that's yanking at it, it doesn't break it up into parts, as you can.

But If you largely oxidize the film, two-thirds or three-quarters of the way, before you put it on the surface, then the strains or stresses that are set up in there as the film dries, become almost zero. You've eliminated one of your breakdown factors right away. You'd expect to get greater durability and as a matter of fact, you do.

So, there is a tremendous amount of possibilites, aside from the new materials, which is not my function to cover since they've been covered; just in things that should have been noticed every day in laboratories and something done about it, but which is, as I say, you don't do, you haven't beed doing.

I haven't yet found an alkyd (maybe there are some) maybe I'm just a little asleep, but I haven't found any alkyds, which have been oxidized before they come to the service to be applied. So I'm just suggesting.

Now, these are on a somewhat practical side. Just in passing let

me make another point about glycerine. This is purely from the Glycerine Producers Association's point of view and I'm not aware that the glycerine people know this. But some years ago, a man I knew took glycerine and fatty acids and decided to put them together the way nature puts them together, namely with enzyme—a man named Hamberger.

He died, unfortunately, halfway through the work. It has never been carried on further as far as I know, but it should be. He found that with enzymes, like black paste, he could put together glycerine and fatty acids very successfully in an emulsion phase, stirring at essentially room temperatures over night. It didn't take months or weeks. Nature beats us in the system here. Nature hydrolyzes the fats and then just on the other side of an intestinal wall, puts them together. Just like that, so fast that it makes your hair stand on end. Why we should we have these elaborate kettles, 6,500 gallon size and buildings to house them, when nature doesn't need anything like this?

I think there are possibilities, research possibilities, if we use our imaginations. *The trouble is we don't.* Take lessons from nature's processes. Why not take a look at the processes that goes on inside us? Some of them are objectionable, but a great many of them are very good.

In talking to professors recently for the Paint Research Institute, and getting them to supply more students to the paint industry, I got this objection on the part of a chemical engineering college, not the B. S. chemists or the Ph.D.

The chemical engineering professor says, no, we don't want anybody to go into the paint industry. They say the paint industry is not an engineering industry. I said, no, not an engineering industry? Are you asking me or telling me? Well, they were telling me.

I said, wait a minute, how would you argue that a Dowtherm kettle, 6500 gallon size, with all the coils and jackets and condensers; azeotropic distillation and solvent recovery processes; isn't that chemical engineering—heat transfer?

Oh, yes, but that's done.

I said, you think it's all done now? Well, now, for instance, says I, and I remember the first fellow I hit with it, that's a step forward, and let's say I had something to do with it, but wouldn't we then naturally follow with continuous processes? You get bigger and bigger kettles. There must be a limit to that. How about continuous processes?

Then I had a nasty thought. I said, I am afraid, however, that you chemical engineering professors, because of your lack of research imagination, are not yet capable of designing continuous processes for colloidal material of this kind. Well, that sat a little hard with him, but they bit at the bait, and I think we will begin to get chemical engineers.

But again, all that I am saying is that often the field right in front of us is still pretty fertile to till.

Now, let me go on to some wilder ones. I'm working out a process under the Paint Research Institute, which I hope I live long enought to see get underway.

I spent 15 years in the beginning on linseed oil and a lot of the work I did on this material is now lost because a lot of those fields are gone.

We spent a lot of time on alkyds and we are going to spend a lot of time on epoxies and solvent process kettles and things of that kind. I see some of these things weakening at the roots and I begin to worry.

You worry about the process through which you go. So, you get to the point, you say, well, what is the ultimate? What is the ultimate? Then you get to something that's a little different, a little worthwhile.

Well, the first factor that comes into mind are the materials that we use, trimellitic anhydride is one, but there are just about a million of these materials. The old edition of Beilsteins has 650,000 materials. I didn't count them actually, I weighed it. There are about 650,000 of them. Now, since then, about 350,000 more. It is about a million different materials. All right. That's the greatest reservoir of knowledge in the world. *But we're not using it.*

We're not using it yet. So I said, all right, let's go to the Beilsteins. Let's put a lot of chemists together and assign each a certain number of pages in the Beilsteins to poke through there and pick out the sheep from the goats.

In other words, take out those things that have good functionality, anyone with a long name becuase that means it's got an OH or a carboxyl, or an amino, it's got something interesting, some kind of a group that will do business, at least double bond, or several of them. Well, pick out those that have two or three or four of them and put them on little keysort cards. Put down the name of the compound, its number, then along the margin, print the reactive groups and also the types of reactions that they will undergo addition, condensation, esterification, etc., types of reaction. Sort them into piles where you have capability of the compound of doing at least two reactions simultaneously.

If you take long compounds that will react in two different ways simultaneously, that means you will get two different molecular species in the same flask. That'll be a resin. It's bound to be a resin. It can't be a crystal. If it's big, well over 2,500, it's practically a resin. So you can go into your laboratories tomorrow and if you get any two things that long, put them together, you'll have a resin before night.

It may be black, you may have some troubles, but the numbers are great. So, we'll filter out of the Beilsteins, perhaps there are five or ten thousand compounds that are capable of reacting simultaneously two different ways, making two molecular species simultaneously in the flask.

Now, if each one can react with each other one, and this is entirely possible (start with ten thousand and cut it in half because that's safer) then you've got factorial five thousand. That will give you a big number of how many resins you can make.

Well, you are not going to do that. Nobody can do that. I can only start in, I can only get beyond the A's in my lifetime. What do we do then? The only thing I know is to resort to the digital computer. That will make a

calculation of almost anything in two and a half seconds up to five seconds. I have done this. I have been working on digital computers and actually programming equations and putting them in.

So, let's say we do something like this: We work out the relationship between chemical constitution, namely, groupings or types reaction. I don't know which way to feed it yet, (as this is visionary but it will come). You figure out mathematical formulas with a relationship between constitution and let's say ultra-violet absorption. That's what breaks down a film such as adhesion, or some fundamental property.

You feed in all this information from 5,000 compounds, or something like that, as to their reaction to types, and then you say to the machine, calculate ultraviolet absorption for each of these combinations, four seconds apiece. This takes eight years, 24 hours a day.

You start feeding this bunch of data into the memory cells of the machine and then you say, now, put a block up here, we don't want anything to come out of the machine where ultraviolet resistance is poor; then a certain figure is going to occur from visible down to 2800 angstroms, limited 2800, that's all that reaches the surface of the earth at this altitude.

We do it for adhesion, we set a minimum for adhesion and finally out of the machine comes a few thousand answers and then we are ready to go into the laboratory and go to work and some of them will still be tars.

But, at any rate, we've short-circuited and the main thing we're shooting at, and you can see it, we're looking at the ultimate in knowledge as no other industry has ever done. You feel so good. None of them have ever shot at the ultimate of knowledge. We are. We are thinking about what is possible for all times. Until somebody finds another new compound, we'll have to go back over this eventually.

But a whole new philosophy is in the making here and I am quite sure this is impractical and visionary at the moment, but I'm purposely trying to stir up your imagination to the feeling that while we want some practical things we also want some visions of an entirely different type.

In this connection, I'm going to make one more new point and then I'll quit. Mostly what you buy and synthesize and sell is what I call stuff-CH_2 groups, they're not worth a hoot. They just clutter up space. But as for what you buy and sell, by and large, all the fancy films you make are just rolls of CH_2 groups except that here and there occasionally you have a carboxyl group or a CH_2OH or a double bond or something that is polar or reactive or interesting, and it is the interesting thing that makes the front page.

Those are the things that you are really concerned about, not what you should buy, so I'd like to present the concept that you buy raw materials, based on the number of reactive groups per molecular weight or pound. Now, if you do this, and I have done it, you get a certain figures. Take oil, which has a molecular weight, let's say, of 878, you have an average in linseed oil, of two double bonds along the chair, some three, some two and some one, and some none. You have an average of two reactive groups, two double bonds per chain or set, three acid groups, or esters thereof at the end, to get a total of nine reactive groups per 878. Multiply by a hundred to get the percentage. You get 1.02 reactive groups as a percentage.

Now, if you take styrene-butadiene, they're full of double bonds, but in the end, they aren't. You come up with one reactive in the molecular weight of 103. That's only 97/100ths instead of my 1.02.

In polyvinyl acetate you can get one over 101 molecular weight. It's rather amazing that in the whole bunch of stuff we're dealing with, we have an almost constant ratio of the things we're buying to the molecular weight. So that when you buy a pound of these materials, you are getting pretty nearly the same number of reactive spots, if you count double bonds as well as carboxyl or CH_2OH or things of that type.

So, the little differences may be important and finally will be important, but at any rate, what I'm trying to do is to develop a concept of not just buying something, but what do you get for what you pay. Now, that brings in price.

Now, if the ratios here are about the same, then it comes down to price. So it is something in fatty acids which can polymerize, I don't mean dimer acids, but there is no reason why you can't polymerize fatty acids. Anything is possible today in organic synthesis. Certainly nothing says if we cannot put two fatty acids together to make a dimer; why can't we make a trimer—well, we can, we just haven't done it.

So, we could string these out. Now, you are not going to leave them as fatty acids. You are going to make ethers out of them or something else on the end which won't be as easily hydrolyzed. But I don't believe that the glycerine-fatty acid people have even scratched the surface as to what they can do with their own plentiful cheap raw material, lower in price than some of the others.

And if we go at some rational system like that, I have a feeling that alkyds will have such great possibilities from now on, that we will kind of be ashamed of ourselves as to why we ever allowed ourselves to question whether alkyds would still be with us ten years from now.

I have thought about it awfully seriously, because if we are going to do a lot of work, research work in the Institute, I have to face the thing about the time I get ready to die. Well, I certainly realize that the whole program was set up wrong and I was to blame for it. If I felt that the alkyds didn't have a chance, I should go completely to the copolymers. If I thought the copolymers didn't have a chance, I should limit myself to alkyds or epoxies, etc.

My feeling is that it is more the originality of a group of men like this. If you could only use five percent of originality that you have, imagination and power that you have in your minds, get rid of the blocks that hold you back by conventions, I am sure that we can bring this whole industry alive in a way that it has never even thought of being in the past.

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A Staff Report

Cyclized Rubber in Protective Coatings

Part III

FILM PROPERTIES

Hardness, Elasticity and Adhesion

The horn-like character of cyclized produces excellent hardness and tough films. The levelling and through drying of films is influenced by the type and plasticizer used, a subject which has been dealt with earlier. For practical applications, cyclized rubber must be plasticized, but it should be mentioned that straight cyclized rubber films have a certain amount of elasticity, which is not sufficient for practical purposes, especially for exterior use, and has to be improved through the addition of plasticizers, oils, alkyd resins, etc. It is well known that pigmentation influences film elasticity. There is, for example, a noticeable difference between pigmentations using zinc oxide and titanium oxide. Accelerated aging tests indicate that films pigmented with zinc oxide have distinctly superior elastic properties than those pigmented with titanium dioxide.

The adhesion of cyclized rubber paints must be classified as excellent in every respect, even to smooth surfaces. Cyclized rubber paints have excellent adhesion to cement and brick surfaces. The alkalinity of fresh cement as well as a higher humidity content do not impair the adhesion of cyclized rubber paint films, provided, however, that paints are properly formulated and applied. The adhesion is extremely good to wood, using cyclized rubber-alkyd resin combinations. Despite the fact that the adhesion of such films can be classified as good, when applied over untreated aluminum etc. it is advisable to prime "light metal" surfaces.

Film properties and chemical resistance of cyclized rubber coatings are discussed in this installment. Part IV, scheduled for the April issue, will deal with humidity-, weather-, and the heat-resistance of cyclized rubber coatings and some practical applications of cyclized rubber in surface coatings.

Porosity

Freedom of pores is a property which is responsible, to a high degree, for the durability and the protective value of surface coatings under severe conditions. Careful investigation using different test methods proved that cyclized rubber films are practically free of pores. The paint formulator is familiar with the difficulties in designing a coating which is free of pores and knows how many coats are needed to obtain such a pore-free coating. The advantage of the tightly closed cyclized rubber films is clearly indicated.

Swell Resistance

A further property of "Alpex" films is their excellent water resistance. It is responsible to a high degree for the resistance of such paints against water and chemical solutions. The water absorption of cyclized rubber films is so small, that it can be hardly determined. Figure 6 demonstrates the water absorption during a 3 week immersion of a cyclized rubber film in water. The film was cast from an "Alpex" solution in mineral spirits. The method used for determing water absorption was gravimetric. The water absorption can only be positively measured when a film plasticized with "Arochlor" 1248 was used.

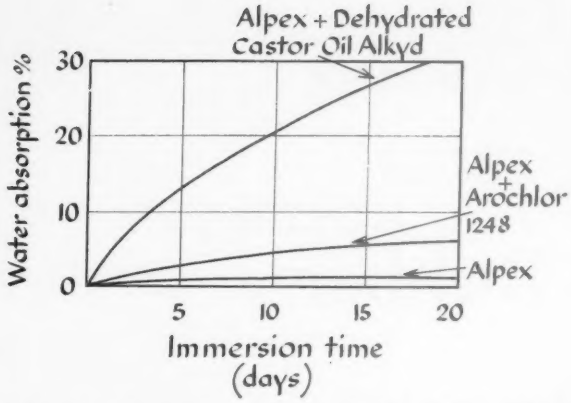


Figure 6. Absorption of unpigmented cyclized rubber rubber films during water immersion.

Furthermore, it is worthwhile to mention that during the water immersion of cyclized rubber films no appreciable changes occur, and that they return quickly to their original conditions. Film hardness is only slightly reduced through water immersion, and the films are not hazy. Figure 7 demonstrates its behavior using a hardness curve of a pure cyclized rubber film during water immersion. It indicates the extreme speed of recovery to its original state after being exposed again to atmospheric conditions. This is also clearly indicated by the excellent gloss retention during and after immersion, and in the case of pigmented coatings, by the color retention. Dry film thickness used for immersion tests was 20 microns. Immersion tests started after films had air dried for two weeks.

Chemical Resistance

One of the most important properties of cyclized rubber films is their high chemical resistance. The character of the starting material of cyclized rubber namely natural rubber, is clearly retained. The resistance against various chemicals is naturally dependent on the composition of the varnishes. The highest resistance is obtained against acid and alkali

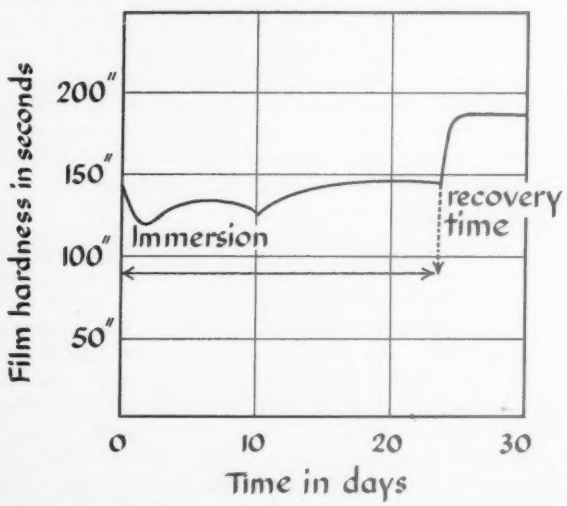


Figure 7. Hardness of unpigmented cyclized rubber films during and after water immersion.

attack if unsaponifiable or chemically inert plasticizers are used. For exposure to oils, fats or aliphatic solvents these plasticizers are not suitable, because of their solubility in these media. In such a case only special binders having cross-linking properties can be used. The total thickness of a paint system applied is a decisive factor as to its prtective value. For high-chemical resistant coating systems not less than one prime coat and three top coats are recommended, having a total dry film thickness of not less than 150 microns. If the number of coats is increased to 6, an improvement can be achieved, additional coats do not improve the resistance.

A concise survey pertaining to the resistance of cyclized rubber paints against various materials under average conditions is listed in Tables VIII and IX. Results are obtained through laboratory tests. Four coats of a pigmented "Alpex" Arochlor combination were applied and tested after 14 days air-drying period. They were tested in several series under time limited conditions. The results shown in the tables must be regarded as a matter or orientation, because the composition and structure of the paint system cannot be of optimum value in every instance mentioned. Under practical conditions more favorable results were often observed.

Summary

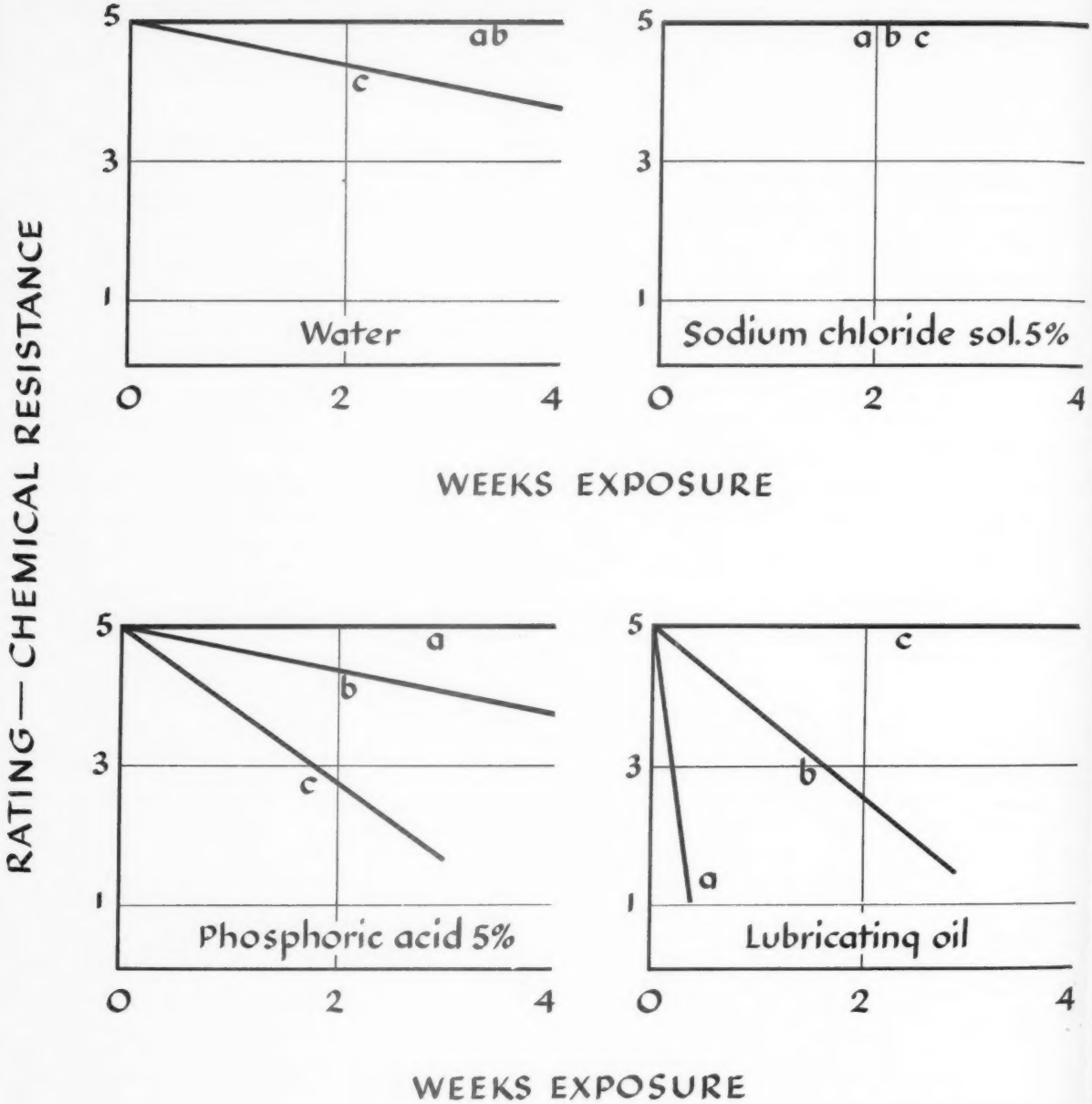
Cyclized rubber has very good resistance against water, sodium chloride solution, hydrochloric acid, nitric acid, sulphuric acid, phosphoric acid, acetic and lactic acid, oxalic acid, citric acid, tartaric acid, sodium hydroxide solution, sodium bisulphate, bleaching solution, formaldehyde, glycerol, limited resistance against: conc. inorganic acids such as hydrochloric acid, sulphuric acid and nitric acid. Poor resistance against aniline, phenol and fatty acids. It has been mentioned before that the resistance of cyclized rubber coatings can be influenced through modification of the composition. As an example Figure 8 demonstrates the behavior of two long oil "Alpex"-Alkyd resin combinations in comparison with an "Alpex"-Arochlor combination during permanent exposure to various chemicals. The paint system in question consists of 1 prime coat and 3 top coats of the following binder composition of the finishing coats (calculated on solids).

Against water and neutral salt solutions, such as sodium chloride solutions, alkyd resin combinations are of very good resistance. The resistance against acids is also good, but diminishes, however, with increasing proportions of alkyd resin. Under the action of alkali the saponification of alkyd resins becomes noticeable and, therefore, short exposure times up to several hours are only permissable. Of absolute and permanent resistance against these agents are the "Alpex"-Arochlor 1248 combinations (Example "a"). Entirely different is the situation under the action of oils. The paint plasticized with Arochlor fails and coatings with good resistance can only be obtained with higher quantities of alkyd resin.

It appears logical that for the formulation of high chemical resistant coatings, inert pigments should be used exclusively. The use of other pigments such as zinc oxide has produced favorable results in most

Medium	Concentration %	Exposure Time	Resistance Poor	Fair	Good
Acetone		30′	√		
Ethyl acetate		30′	√		
Ammonia	1	1 year			√
"	10	6 mo.		√	
"	Conc.	6 mo.		√	
Formic acid	1	6 mo.		√	
" "	10	6 mo.		√	
" "	Conc.	6 mo.		√	
Aluminum sulphate	5	6 mo.			
Gasoline	—	5 min.	√		
Benzine	—	5 min.	√		
Butter		24 hrs.	√		
Chromic Acid	1	6 mo.			
" "	10	6 mo.	√		
Chlorine Water	8 gr. Cl_2 1000 ccm	6 mo.	√		
Acetic Acid	1	6 mo.			√
" "	5	6 mo.			√
" "	20	6 mo.		√	
" "	Conc.	6 mo.		√	
Hydrofluoric Acid	1	6 mo.			√
Formaldehyde	30	6 mo.			√
Glycerol	30	6 mo.			√
NaCl	—	6 mo.			√
NaCl Sol.	5	6 mo.			√
NaCl Sol.	20	1 year			√
NaCl Sol.	Saturated	1 year			√
Tide 2% + ½% NaCl-25° C.		32 hrs.	√		
Potassium Bichromate	5	6 mo.			√
" pe manganate	5	6 mo.		√	
Linseed oil raw		24. hrs.	√		
Milk		24 hrs.	√		
Monochloro acetic acid	5	6 mo.			√
Sea water		1 year			√
NaOH Sol.	1	6 mo.			√
NaOH Sol.	5	6 mo.			√
NaOH Sol.	20	6 mo.			√
NaOH Sol.	50	6 mo.			√
Phosphoric acid	1	6 mo.			√
" "	5	6 mo.			√
" "	20	1 year			√
" "	Conc.	1 year			√
Phenol. tech.		24 hours.	√		
Hydrochloric acid	5	6 mo.			√
" "	10	6 mo.			√
" "	Conc.	6 mo.		√	
Nitric acid	1	6 mo.			√
" "	5	6 mo.			√
" "	20	1 year			√
" "	Conc.	6 mo.	√		
Lubricating oil		24 hr.	√		
Sulphuric acid	1	6 mo.			√
" "	5	6 mo.			√
" "	20	6 mo.	√		
" "	Conc.	6 mo.	√		
Sulphurous acid	1% SO_2	6 mo.		√	
" "	5% SO_2	6 mo.	√		
Soap solution	1%	6 mo.			√
Ethyl alcohol		2 mo.			√
VM&P Naphtha		24 hrs.	√		
Water 25° C.		1 year			√
Water 80° C.		15 hrs.		√	
Water dist.		1 year		√	
Sodium silicate sol.	Conc.	1 year			√
Tartaric acid	5%	6 mo.		√	
Oxalic acid	5%	6 mo.	√		
Lactic acid	5%	6 mo.	√		

Table VIII. Chemical resistance of cyclized rubber paints. (tested at normal temperature 20-25 deg. C.)

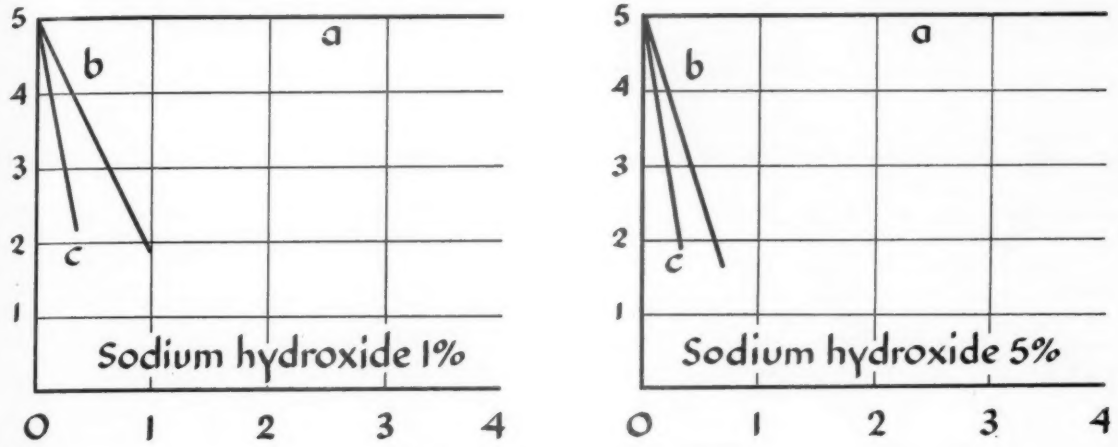


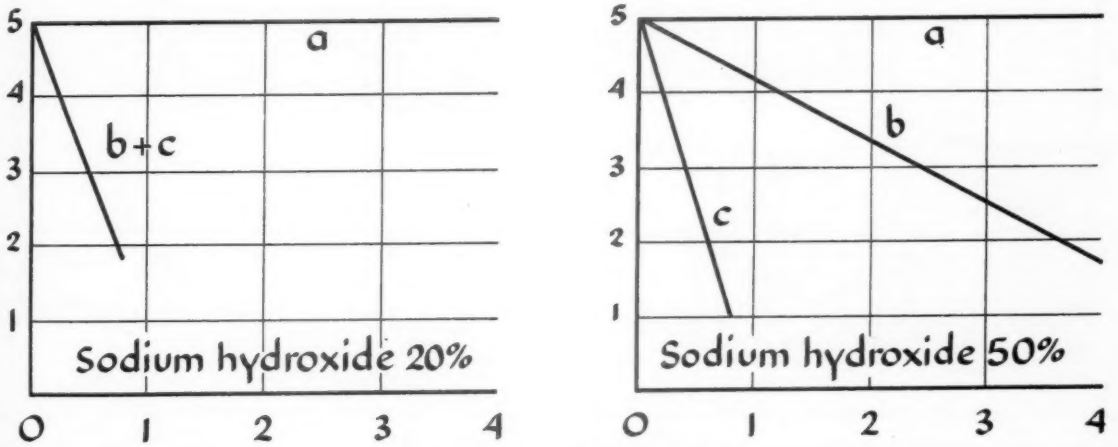
a = Alpex + Arochlor
b = Alpex + Alkydol S-1043, 1:1
c = Alpex + Alkydol S-1043, 1:2
5 = complete protection (coating unchanged)
3 = limited protection (coating slightly attacked)
1 = no protection value (coating practically destroyed)

Figure 8. Chemical resistance versus binder composition.

The curves indicate the condition of the protective coating using the following grade numbers:

5 = complete protection (coating unchanged)
3 = limited protection (coating slightly attacked)
1 = no protective value (coating practically destroyed)





Chemical Resistance and Composition of Alpex Binder

a = Alpex + Arochlor 1248
b = Alpex + Alkydol S-1043 ratio about 1:1
c = Alpex + Alkydol S-1043 ratio about 1:2

	a	b	c
Alpex	72	50	34
Arochlor 1248	28	10	3
Alkydol S-1043	–	40	60
Linseed oil	–	–	3
	100	100	100

Figure 8. Chemical resistance versus binder composition

Medium	Concentration in water %	Exposure Time	Poor	Limited	Resistant
Aluminum sulphate	5	2½ mo.			√
Acetic acid	5	2 days			√
Sodium chloride sol.	5	2½ mo.			√
Potassium Bichromate	5	2½ mo.			√
Tap water		2½ mo.			√
Sodium hydroxide sol.	5	24 hrs.			√
Phosphoric acid sol.	5	8 days			√
Nitric acid sol.	5	8 days			√
Hydrochloric acid sol.	5	8 days			√
Sulphuric acid sol.	5	24 hrs.			√

Table IX. Chemical resistance of cyclized rubber paints (exposed at 60 deg. C.)

cases. The sole pigmentation with titanium dioxide has the well known tendency to chalk during outside exposure.

Exposure tests also proved that cyclized rubber films when pigmented with titanium dioxide lose their elasticity quicker than when pigmented with zinc oxide. Based on experience obtained recently that the use of zinc oxide does not practically impair the resistance of cyclized rubber films, these pigments can be used to a large extent in the formulation of chemical resistant coatings and increase the resistance of the films against the action of ultraviolet rays.

It goes without saying, that pigment to binder ratio is of importance. Over pigmentation reduces chemical resistance. A maximum resistance is obtained for example if a pigment volume content of about 20% is used in an Alpex-Arochlor 1248-titanium dioxide system, as shown in Figure 9. Higher or lower pigmentation reduces the resistance of the coatings.

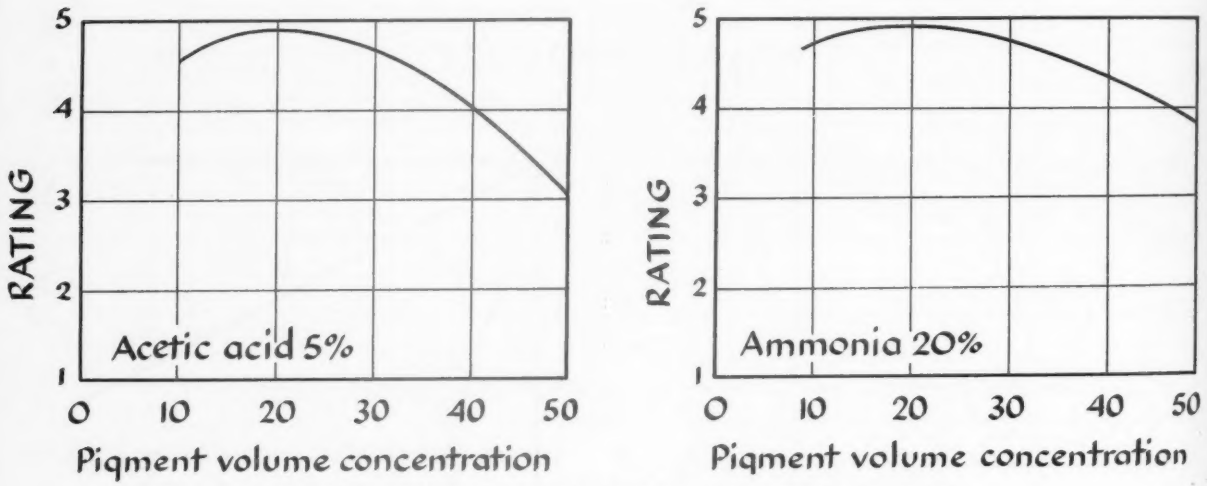


Figure 9. Pigmentation vs. chemical resistance of cyclized rubber paints.

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By
Phil Heiberger

The author continues his random reflections on various aspects of the paint industry. The opinions expressed in this column are his alone and do not necessarily reflect those of this publication.

Plight of the Paint Chemist

SOME well-worn famous last words: "But it worked beautifully in the laboratory!"

P. Heiberger

In pinpointing that oft fatal slip 'twixt lab and customer, much of the onus now falls on our nice new whipping boy, air pollution which, we understand, can really wreak havoc with the best tested formulae of laboratory chemists.

But, cheer up, paint formulators of the world! I bring you glad tidings. We are not alone. The reason misery loves company is that, when there's enough company, it becomes a problem of wide concern and that's all to the good because then something's likely to be done about it. So read the following and take heart.

Contaminants and Colorfastness

The American Association of Textile Chemists and Colorists is, in many respects, equivalent to the Federation of Paint and Varnish Production Clubs in the sense that it forms committees to investigate problems of its industry. One such committee is the "Research Developments Committee on Colorfastness to Light." Joseph E. Norton, chairman, reported on the work of his committee in the January 12, 1958 issue of the *American Dyestuff Reporter*.

In this report, Mr. Norton stated that "The change in color of a textile material due to the action of light is an extremely complicated process in which many factors contribute to the amount and type of color change produced." Four subcommittees have been formed to study these factors, each concentrating on specific and limited areas.

Subcommittee I is studying AATCC Sunlight and Daylight test methods in order to establish statistical limits of reproducibility and repeatability and to suggest modifications of methods and standards.

Subcommittee II will study laboratory methods in an attempt to improve their correlation with natural light tests. Subcommittee III is investigating the combined effects of light and atmospheric contaminants. The fourth subcommittee will deal with colorfastness to weathering as differentiated from the physical changes in textile materials due to weathering.

All this work will undoubtedly have a bearing on our industry, particularly the work of Subcommittee III. A preliminary report was published in the June 30, 1958 issue of *American Dyestuff Reporter*. It stated in part, "From this and subsequent work it is now believed that information may be developed which will be of great help in explaining some of the reasons for the wide variations encountered on some materials in natural light exposures and particularly the daylight exposures made at different times and locations."

The following quotation is most significant: "There are indications that there is a cumulative effect of light combined with atmospheric contaminants which does not occur when the various factors are applied individually. In many cases peculiarities in fading have been attributed to moisture sensitivity. We now believe that these may actually be caused by atmospheric contaminants whose activity is, of course, greatly increased by the presence of higher amounts of moisture which is encountered during the night in the daylight test."

Complaints and Criticism

DAVID B. Singer's "New Books" column in the January 1959 *Industrial Laboratories* overflows with essentially valid criticism of the field of technical book publishing. First of all, he laments the fact that of the 200-300 technical books published in the United States each year for practicing scientists and engineers in industrial laboratories, few make any worthwhile contribution to their

field. Most, he complains, offer little more than a rehash of previously published and widely available information.

While he is willing to concede that chemistry books tend to be less guilty on this score than books on mathematics, physics, and classical mechanics, he nevertheless bemoans the fact that technical and professional societies do not make a practice of underwriting sabbatical leaves for acknowledged research leaders for devotion to manuscript preparation. This kind of support, he believes, would greatly improve the quality of technical books for non-students.

Authors of technical "classics," Mr. Singer feels, are accorded neither the recognition they deserve nor sufficiently attractive monetary rewards to provide incentive, and the technical publishing field suffers as a result.

Translation Trials

Singer also bemoans the fact that while scientific books and articles published abroad are notable for their vigor and quality, they are largely inaccessible to Americans because of either non-existent or minimal knowledge of the French, German, and Russian languages. Good foreign works should be published in English, he says, obviating the need for translation services for each scientist who wishes to refer to them.

We Hate to Wait

Another complaint is the excessive time lag between the moment a subject becomes "hot" and appearance of the first good book about it. Unfortunately, Singer fails to suggest a remedy for this situation, which is not too surprising. It's a knotty one.

Of course, in all fairness to publishers, it should be admitted that they do try to abbreviate this waiting period as much as possible. But here, as elsewhere, they are caught between opposing objectives: speed versus quality, and trapped in an inevitable conflict: large investment versus limited sales possibilities, especially if the field is a rather narrow one without broad appeal.

Concise, Compact, and Convenient

The trouble is that when a practicing scientist would like to inform himself or bring himself up to date on a particular subject, it often becomes a major chore merely to compile an appropriate bibliography. The time he yearns to spend on study and assimilation of the data he must dissipate instead on tedious and frequently frustrating literature searches.

How annoying it is to patiently assemble what looks like a good collection of books and articles only to find on close examination that several of them, rather than complement each other's weaknesses, merely duplicate them, repeating essentially the same information in different words and in slightly different organization. Unfortunately, there's rarely a way of foreseeing one's disappointment until precious time has been irretrievably lost.

How convenient it would be if concise, compact, up-to-date texts on all subjects of interest to us could be published at frequent intervals and readily located, eliminating those irritating wasted efforts. Maybe after the invention of a "good five-cent cigar" we can start looking for this kind of service from our technical publishers.

N.S.F. to the Rescue

The Science Advisory Committee has evidently been mulling over this very problem as well as other related problems that continue to grow apace. According to *Scientific American* of February 1959, the Committee has proposed and President Eisenhower has approved a plan to cope with them. The idea is to coordinate and bolster the information services already in existence rather than create a new national translation and abstracting center.

The National Science Foundation will help finance the publication of journals and monographs. It will sponsor the preparation of world-wide lists of scientific publications, classified by subject and indexed. It will encourage the translation of papers from Russian and Japenese and other languages that few U. S. scientists read. Also, it will support research on better methods of storing, indexing, and retrieving information.

Myriads of Manuscripts

When you contemplate the 55,000 journals containing 1,200,000 significant articles in the physical and life sciences, the 60,000 scientific books, and approximately 100,000 isolated research reports published throughout the world each year, you begin to realize the enormity of the job to be done.

Film Evaporation

IN this age of complex technology, it is always somewhat of a shock to find a simple method for observing a complex phenomenon. By now we are all familiar with those efforts designed to retard the evaporation of water in hot dry water-poor areas. The most prominent method is the use of a monolayer of cetyl alcohol. The usual technique of measuring the rate of evaporation from a quiescent surface and the effect of monolayers upon this is rather elaborate, yet it does not provide any information about local conditions over small portions of the area studied.

A report entitled "Direct Observation of Evaporation from Quiescent Water" by Karol J. Mysels, and reported in the September 15, 1958 *Science*, may have some direct implications based on a simple technique which gives qualitative but very direct visual information about the rate of evaporation and shows what happens over areas of the order of a few square millimeters. The technique is based on the color change produced by the vapor reaching a sheet of paper impregnated with cobaltous chloride and held very close to the surface. This gives a good indication of the rate at which evaporation proceeds from individual regions of the surface.

In so doing, the marked effect of some monolayers on thermal convection currents within the liquid can be shown. It seems that this technique may be adapted to measuring the rate of paint film evaporation under various conditions.

Oil Analysis

EVEN in this day of synthetic intermediates, there are chemists who are interested in analyzing oils for unsaturated fatty acid content. A system for rapid total analysis of complex fatty acid mixtures on a submilligram scale is described by W. Stoffel et al in *Proc. Soc. Exptl. Biol. Med.* **99**, 238 (1958). It's a chromatographic method, of course.

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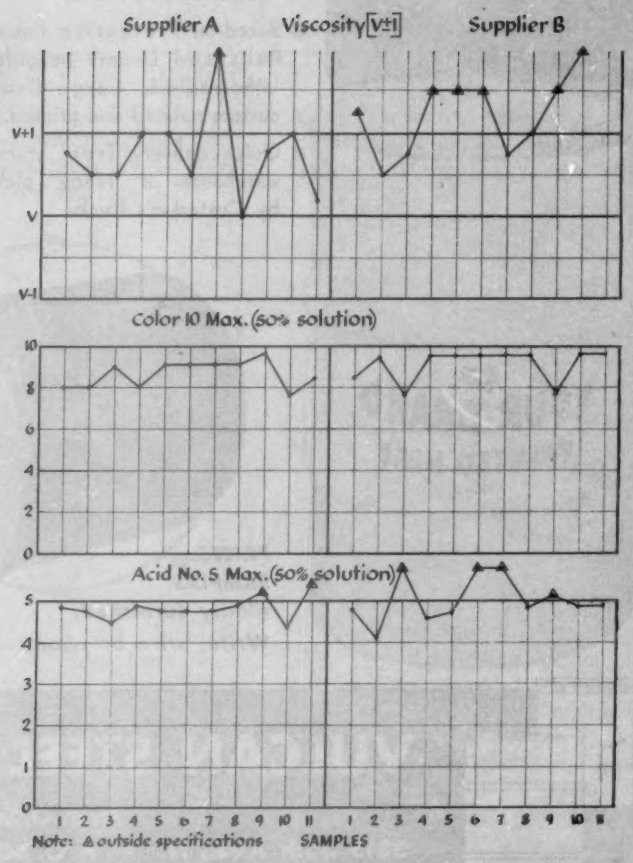

The above chart graphically shows how two alkyd vehicles from different suppliers compare in specification properties. Setting specifications in raw materials is important for building quality into your finished product. For complete details, see page 77.

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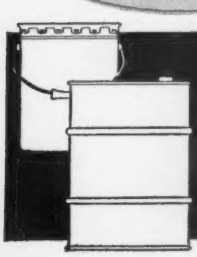

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QUALITY CONTROL— AN AID TO PRODUCTION

By
Lawrence Shatkin

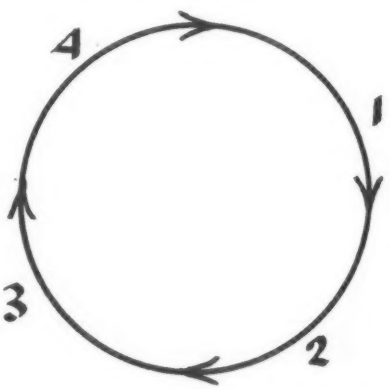
OLIVER Goldsmith remarked, "I . . . , chose my wife, as she did her wedding gown, not for a fine glossy surface, but such qualities as would wear well." The image of this inherent quality, in the minds of the consumer, will determine the success or failure of a company.

In order that quality control be effective, it must be integrated into the over-all management structure. This means that we are concerned with events "before" the product is made, rather than the "after" concept. Furthermore, we broaden our scope by adopting the principle of "Total Quality Control" which begins with the inception of a product, and is concluded only after the customer has re-ordered.

Diagramatically, the old concept of quality control could be described as follows:[1]

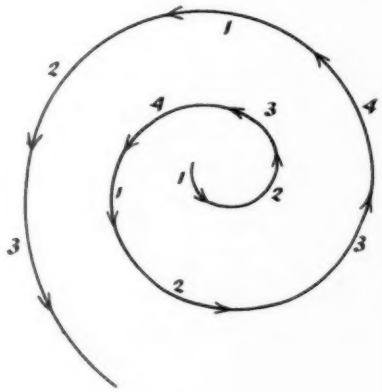
Design it → Make it → Try to sell it

The new approach brings in another step which results in a cycle, whereby guessing is eliminated to a large degree:



This additional step involves market research which feeds back information to the manufacturer as to what the consumer thinks of the product. When necessary, modifications or a complete over-haul takes place.

This analysis has been taken one step further, where manufacturing and market research are done on a pilot scale, and the results used as a guide for further expansion. The cycle takes on the aspect of a spiral, as follows:



Standards and Specifications

In the purchasing of labels, specifications should be compiled in order to standardize the dimensions so as to ensure continuous operation over the labeling machine.

Specifications for a group of labels could be described as outlined in Table I.

The above language is understood by both the buyer and seller

1. Deming, W. Edwards. "On Statistical Techniques in Industry as a National Resource," reprinted from the Bulletin of the International Statistical Institute, Vol. XXXIII, Part V, pp. 123-133.

The opinions expressed in this feature are not necessarily those of any particular firm or organization.

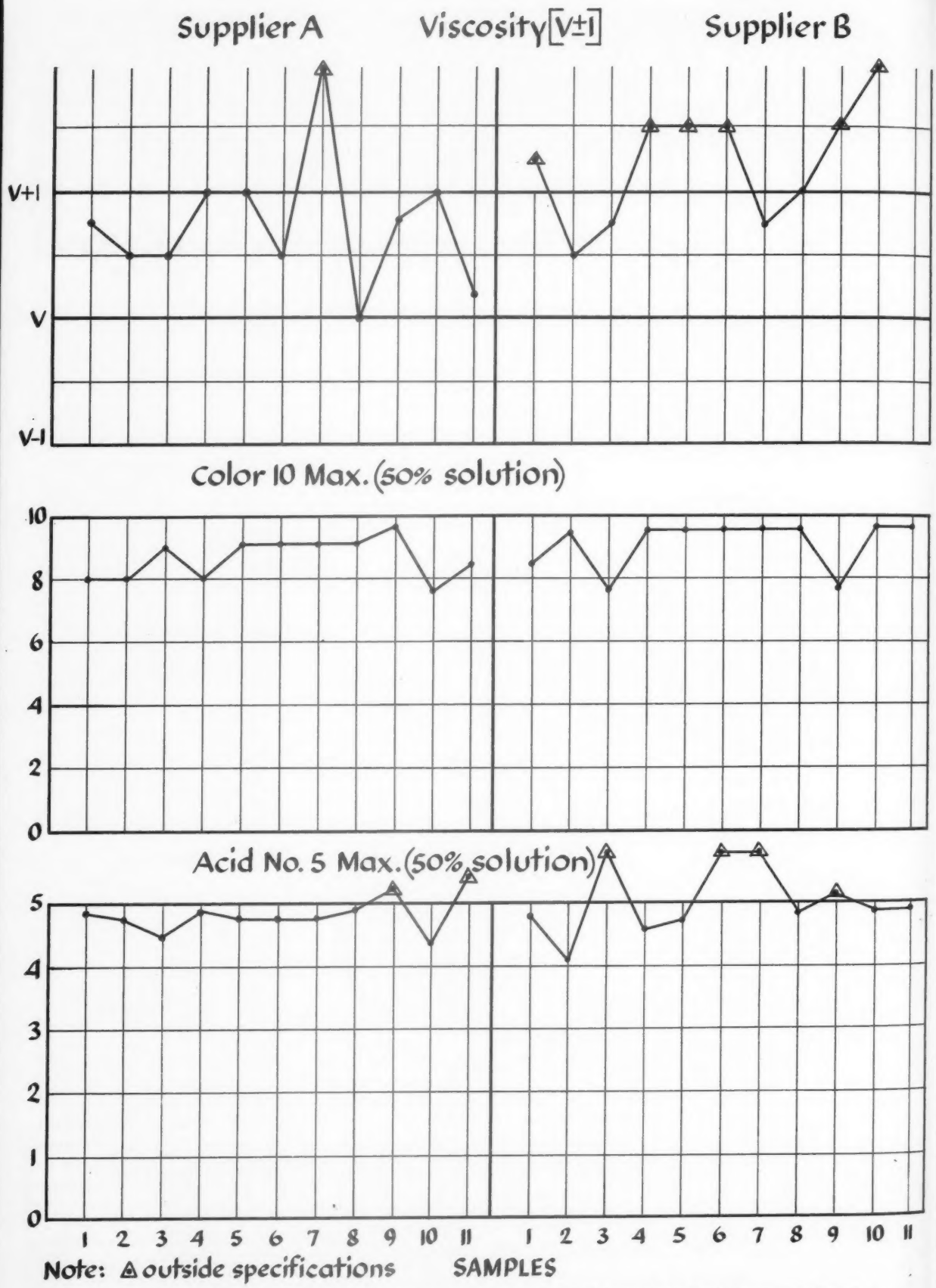


Figure 1. Important specifications for determining quality of raw materials can be depicted by means of graph.

no matter where they may be located.

Incoming Raw Materials

The planning of periodic ratings of the quality performance of suppliers provides facts which assist the purchasing department in comparing the characteristics of goods supplied. For example, in constructing a simple diagram of alkyds purchased, the important properties can be depicted by means of a graph. (See Figure 1).

Evaluating the quality capability of these suppliers provides facts which assist in selecting good quality vendors. In addition, a view of these diagrams will indicate the course of events and enable you to alert your supplier that his material is approaching the upper limits of the specification, so that the necessary modifications can be made before the next shipment. This approach enables you to build quality into your product since it is impossible to inspect quality into the product. Final inspection of an item will tell you where you were, and will not tell you where you are going. A simple chart will aid in indicating where you are, and where you are going as well.

Ordering and obtaining acceptable raw materials and component parts is largely controlled by the ability of buyer and seller to agree on a definition of quality; that is, the setting of specifications.

Responsibilities of Quality Control

Although the number of complaints or returns are helpful as one indication of the success of a quality control program, it is not sure evidence of customer satisfaction. Consideration has to be given for cost in terms of repairs, scrap, inspection hours and other efforts to achieve customer satisfaction.

Furthermore, quality control has the responsibility of defining risks of errors in decision, the prevention of non-conformity of products, the process of capability studies, the measure of quality and the reporting of quality information.

Quality Control is a service department affecting all divisions: Research and design, engineering, purchasing, production and materials control, sales and promotion. With today's profit squeeze, quality control can make a worthwhile contribution toward reducing manufacturing costs, improving quality, and enhancing customers' acceptance.

Quality control viewed in its broad perspective can bring about innovations to offset the increasing pressures on consumer acceptance of quality, quality costs, and obsolescence of quality techniques. A. V. Feigenbaum stated, "I think price or delivery or promotional stunts may sell a product the first time. But it's going to be quality that keeps the customer coming back the second, third, or fifteenth time."

Size of Label (for cans)	Width	Length	Tolerance
1 gal. label	7 1/8"	21¼"	±1/32"
¼ " "	4½	13 7/8	"
1/8 " "	3 9/16	11 1/8	"
1/16 " "	2½	9½	"
1/32 " "	1 11/16	8 5/16	"
1/64 " "	1 3/4	7 1/8	"
(for jars)			
1/16 " "	2 5/16	9 7/8	"
1/32 " "	1 11/16	8 3/8	"
1/64 " "	1 7/16	7	"

All labels, from 1/64 to 1 gallon, are to have a border 5/8" wide.

Table I. Outline of specifications for a group of labels.

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New Developments

Short-Oil Alkyd Compatible with Parlon

The fortifying action of Parlon chlorinated rubber in alkyd resin finishes is well-known, and is widely used in the formulation of traffic paints and other specialized finishes. The metal-finishing field has been unable to capitalize to the fullest extent on the advantages of Parlon as an alkyd modifier, since its use has been limited to the slower drying medium—and long-oil types of alkyd resins.

Now Cellolyn 604, a short-oil alkyd designed especially to be compatible with Parlon, is available for the formulation of fast-drying, durable, low-cost industrial finishes. Cellolyn 604 is available as a solution in xylene at 60% nonvolatile, designated Cellolyn 604-60X.

Properties of a Typical Solution of Cellolyn 604-60X

Type alkyd	oxidizing
Viscosity (Gardner-Holdt) at 25° C.	Z1
Color (Gardner 1933 Standards)	5-6
Acid numbers (solids)	10
Weight per gallon, pounds	8.3

Product finishes containing 70% of Cellolyn 604 and 30% of Parlon S10 give tack-free drying times of 30 minutes. This, of course, means a reduction in dust pickup as compared to the slower drying production finishes. In addition, such finishes show other advantages—increased hardness and mar resistance, greater resistance to humidity and alkalies and acids, increased abrasion resistance, and easier cleaning.

The data in Table I compare the performance of a typical Parlon-Cellolyn 604 metal-finishing enamel with that of a Parlon-medium oil alkyd finish. It will be seen that the Parlon-Cellolyn 604 combination (A) is faster drying, has slightly better chemical resistance, and is lower in cost than the Parlon—medium oil formulation (B).

As is true of most all drying-oil alkyd formulations, these Cellolyn 604-Parlon coatings tend to be self-lifting when applied over themselves after only 2 to 72 hours dry. Where the coating is to be used for one-coat application only, this self-lifting is not a problem, and these coatings can be used unmodified. For multi-coat applications, a coating based on Parlon using both Cellolyn 604 and the nondrying alkyd Cellolyn 502 form fast-drying, hard, glossy films which do not exhibit any lifting tendencies. Most economical of these is 30:40:30 Parlon: Cellolyn 604: Cellolyn 502 formulation.

Address inquiries on Cellolyn 604 or Cellolyn 502 to Synthetics Department, all inquires on Parlon to Cellulose Products Department, Dept. PVP, Hercules Powder Company, Wilmington 99, Del. Information on these products can also be obtained from any Hercules district office.

Formulation	A	B
Parlon® S10	30	30
Dyphos stabilizer	1.5	1.5
Cellolyn® 604	70	–
Medium-oil oxidizing alkyd	–	70
TiO_2, rutile	100	100
Driers—metal content based on alkyd solids		
% Cobalt, as naphthenate	0.07	0.05
% Calcium, as naphthenate	0.1	–
% Lead, as naphthenate	0.5	0.5
Solids (at 20 sec., No. 4 Ford Cup), %	46	44
Evaluation		
Tack-free time, hr.	½	1
Through-dry, hr.	2	3
Sward hardness, 24 hr.	32	32
60° Photovolt gloss	89	88
Adhesion, after 1 week air-dry,		
Bonderized steel	good	excellent
Untreated steel	good	fair to good
Chemical resistance—		
H_2O	OK - 3 wk.	OK - 3 wk.
10% HCl	OK - 3 wk.	Bl. - 2 wk.
1% NaOH	S. - 5 days	S. - 5 days
Gasoline resistance, 1 hr. immersion,		
Gulf Regular	OK	OK
Golden Esso Extra	P	S-P
Cost/lb. vehicle solids	$.43	$.47

Legend: Bl. – blisters
S. – softens
P. – pink

Table I. Comparison of Parlon Alkyd coatings.

Continuous Container Fill Control System

A new concept of control in can or package filling operations is provided by the AccuRay Continuous Container Fill Control System, now being produced by Industrial Nucleonics Corporation, Columbus, Ohio.

The system measures average height of fill in containers and actuates feedback control of the filling machine.

The high degree of sensitivity developed by the system is said to permit measurements within ± 1/64 inch of target fill level with liquid products. Reliability of the system is assured from a minimum production rate of 60 containers per minute to an unlimited maximum rate. Feedback control of the filling machine is automatic and continuous.

A fill measuring head and a fill control instrument comprise the system. Containers are conveyed between a long-lived gamma energy source and a detector in the measuring head. The amount of energy reaching the detector varies in proportion to fill height in the containers, and the detector produces a signal related to average height of fill. This signal is indicated on a meter in the fill control instrument. Integral with the meter are "high" and ""low contacts, from which feedback control of the filler is actuated. The fill control instrument may be either panel mounted or wall mounted adjacent to the conveyor line.

The fill measuring head, which occupies only 25 inches of conveyor direction space, is lightweight and easily installed; yet, rugged housings of stainless steel permit water or steam washdowns at any time. Installation and maintenance costs are minimal. No complex piping or wiring is required.

The system is applicable to either liquid or dry fill in containers of various sizes and shapes. Simple adjustment of the measuring head can be made whenever container size or fill level specifications are changed. The wide range of adjustments also accommodates low fill measurement and control in phase or sequence filling when target level may be low in the container. The system may be used either before or after capping operations.

Ready application of the AccuRay Continuous Container Fill Control System is found in chemical packaging, the petroleum industry, paint and spray production, etc. Increased profits accrue through product savings, decreased downtime, and product uniformity.

The new system is a companion product to the AccuRay Individual Container Fill Inspection-Rejection System, which inspects up to 1,000 filled containers per minute and rejects all containers not meeting predetermined specifications.

Additional information may be obtained from Industrial Nucleonics Corporation, Dept. PVP, 1205 Chesapeake Ave., Columbus, Ohio.

New Type House Siding Developed

Development of a completely new type of house siding made of vinyl coated aluminum promises to simplify home exterior maintenance to an occasional washdown with a garden hose.

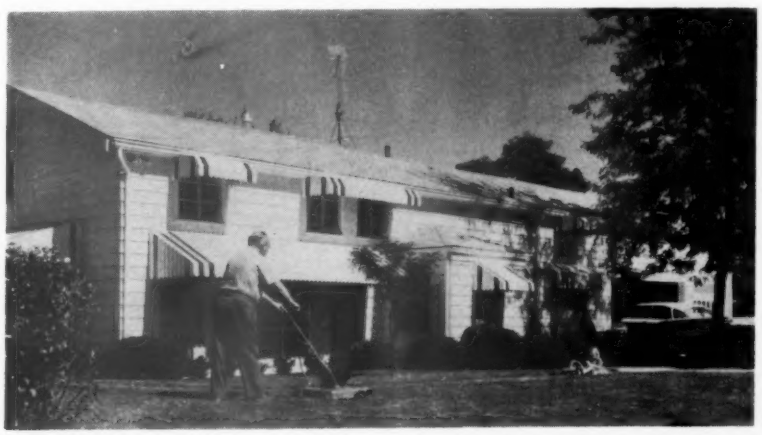
The carefree new siding, developed and marketed by Hastings Aluminum Products, Inc. of Hastings, Mich., retains its durable finish and attractive appearance through rigorous weather for years and years without requiring repainting.

The aluminum siding is coated with a special formulation made with Geon vinyl resin supplied by B. F. Goodrich Chemical Company. Both sides of the aluminum are coated before the siding is fabricated. The metal then can be formed, bent, punched, and even applied to the house without affecting the appearance or exceptional performance of the finish.

The enamel-like Geon coating—called "Superclad"—is by Sherwin-Williams Inc. It produces not only outstanding appearance but also a wear and weather resistance far beyond finishes heretofore available. Durability is such that the manufacturer warrants the finish against blistering, cracking, or crazing for ten years.

Extensive laboratory and field tests have proved the outstanding properties of the Geon finish under all conditions.

Available in white and a variety of pleasing pastel colors, the siding panels come in ten foot lengths with a full eight inch exposure for economical applications. The panels lock together to form a weathertight V-groove so there are no exposed nail heads.



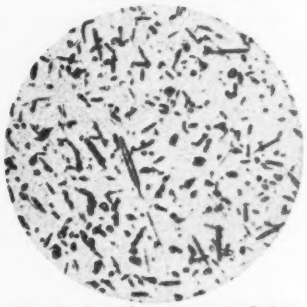
New type of house siding is covered with enamel-like Geon coatings. Both sides of the aluminum are coated before forming. Special formulation made by Sherwin-Williams, Inc., said to produce outstanding appearance and weather resistance. Siding is made by Hastings Aluminum Products, Inc.

AZO

acicular ZINC OXIDE gives paint Extra durability

Forty years ago, American Zinc produced the original acicular lead-free zinc oxide that received wide acceptance by the paint industry and led the way over the years to improved durability from zinc oxide in exterior paints. AZO acicular zinc oxides are available over a wide range of oil absorptions to give you the required paint consistency.

For High Consistency in Paints
AZO ZZZ-22



For Medium Consistency in Paints
AZO ZZZ-11

For Low Consistency in Paints
AZO ZZZ-33

AZO acicular zinc oxides are free from detrimental colloidal fines, produce exceptional weathering properties in exterior paints, and are resistant to hard settling during shelf storage. For general use in the production of paints and enamels.

1ST

American Zinc was the first, *and is still the only* producer of acicular lead-free zinc oxides covering a wide range of oil absorptions from high to low *and including the intermediate ranges.*

ALL AZO PAINT GRADE ZINC OXIDES AVAILABLE AS AZODOX (De-Aerated)

AZODOX has twice the apparent density, half the dry bulk. Faster handling, easier storing, quicker mixing.

American Zinc sales company

Distributors for AMERICAN ZINC, LEAD & SMELTING COMPANY
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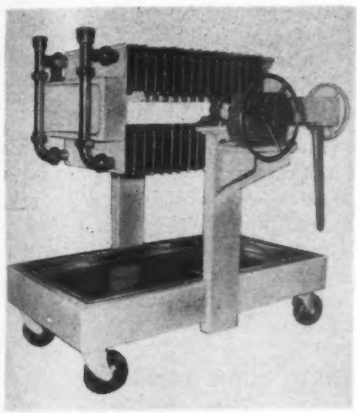
NEW EQUIPMENT AND MATERIALS

This section is intended to keep our readers informed of new materials and equipment. While every effort is made to include only reputable products, their presence here does not constitute an official endorsement.



CONSOLIDATED SIPHON

FILTER PRESS
Vertical & Horizontal Position

Filter press is now available to the processing industries for uninterrupted filtering operation. Filter cake will not fall away from plates during operation, even with a pressure drop to zero.

Unit is designed to operate in a vertical position and is equipped with worm gear for turning to a horizontal position for cleaning and loading. Filter plates are 18″ x 18″ with stainless steel filter media supports and screen backing plates. Space can be specified for 1½″, 2″ or 3″ cake.

Filteration surface is furnished from 15 sq. ft. to 100 sq. ft., with from 2 to 35 plates. Capacity rating in gpm is dependent upon the type of liquid being filtered and number of filter plates being used.

Machine is furnished with heavy duty ratchet sealing attachment, removable drip tray, and precision ground surfaces to prevent leakage. Filter media may be of paper, cloth or other material dependent upon the processing operation.

Terriss Division, Consolidated Siphon Supply Co., Inc., Dept. PVP, 22 Wooster St., New York 13, N. Y.

THERMOSTAT
Explosion Proof

Explosion proof thermostat, UL approved for Class 1, Group D hazardous areas, has been announced.

Said to be designed for convenient immersion in tanks, wall installation, and for exposure to contaminated environments, the unit is made up of three subassemblies: a Series 47000 Thermoswitch unit, stainless steel well, and an explosion proof junction box that completely protects the lead wire outlets.

FENWAL

The unit is completely adjustable over a 32°F to 500°F range, and can be exposed indefinitely to -100°F, or, for short periods, to 100°F above its set point. Current rating is 10 amps 115 VAC, or 5 amps 230 VAC.

Fenwal Inc., Dept. PVP, Ashland, Mass.

BALANCE
Determine Moisture Content

A moisture balance for fast and highly accurate determinations of moisture content in a wide variety of materials has been designed.

Principal feature of the new model is its built-in autotransformer which regulates voltage automatically and provides more convenient temperature control than previous moisture balances in which the autotransformer was a separate unit.

Simple to operate by even an inexperienced laboratory technician, the moisture balance is capable of reducing from one-half hour, or more, to only a few minutes, the time required for accurately testing the moisture content of a material.

According to the firm, the balance performs both drying and weighing operations simultaneously, thus eliminating time-consuming weighing of samples on an analytical balance, with subsequent drying in a vacuum oven and then reweighing.

To operate the Cenco moisture balance, a 5 gram sample (exact weight need not be known) is placed in the balance pan and the indicator crank is set for 100 per cent moisture. The hood is then lowered, the lamp switch turned on, and the infrared heat quickly penetrates deeply into the sample. A few minutes later, with moisture driven off, the per cent of moisture lost is read directly on an easy-to-read calibrated scale.

CENTRAL SCIENTIFIC

NEW MATERIALS — EQUIPMENT

The unit also comes equipped with disposable weighting dishes, made deeper than former models.

The built-in magnetic damper reduces pan vibrations and speeds weighings. An extra torsion wire for 25 gram samples is supplied for handling heavier loads.

Central Scientific Co., c/o Richard S. Smith & Associates, Dept. PVP, 176 West Adams St., Chicago 3, Ill.

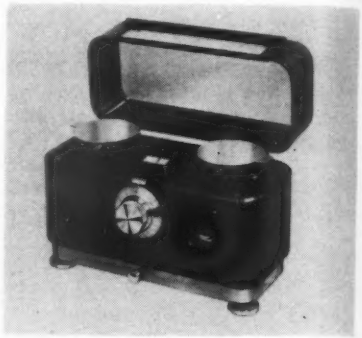
DIAL BALANCE
120 Gram Capacity

Weighings, it is claimed, can be made in 1/3 of the time with the new dial balance now available. Its capacity is 120 grams.

The new design features a simple graduated dial which can be turned without arresting the oil-damped balance, replacing the time-consuming "cut-and-try" procedure. This means that the time consuming portion of the weighting (below one gram) literally can be "dialed in" in 1/3 the time.

The new dial mechanism said to retain its original accuracy after more than a million weighings.

The new dial is graduated from zero to one gram by 10 milligram (.01) graduations. The sensibility reciprocal will be 10 milligrams. In other words, 10 milligrams will move the rest point one index division. The balance is oil-damped to minimize oscillation and greatly facilitates the weighing operation.



TORSION BALANCE

The metal case has a corrosion resistant gray finish constructed to exclude dust and chemicals. The hinged lid is 2-¾ inches high with a glass front and top. The unit measures 11½ x 6 x 8¼ inches.

Torsion Balance Co., Dept. PVP, Clifton, N. J.

MILDEWCIDE FUNGICIDE
Light in Color

A mildewcide fungicide which has been specially formulated for paint manufacture is now being produced. Trade-named Puratol-30, the phenyl mercury compound is said to be extraordinarily light in color. It is stable and compatible as an additive with a broad range of oil, alkyd, latex, and water-based paints.

Another significant feature is the color of Puratol-30. Most commercial phenyl mercury oleates, for example, have a Gardner color rating of about 5. The Puratol-30 product has a color rating of well below 1.

Physical and chemical specifications of Puratol-30 are: Phenyl mercury (calculated as oleate), 30%; minimum equivalent mercury, 10.77%; specific gravity, 0.94; pounds per gallon, 7.8-7.9; flash point (Tag closed cup), 145°F; maximum water content, 0.25%; completely soluble in petroleum solvents.

On an average, 0.5% of Puratol-30, based on total weight of the paint, is adequate to impart effective mildew and fungus resistance. The Gallowhur formulation will not affect color, viscosity,

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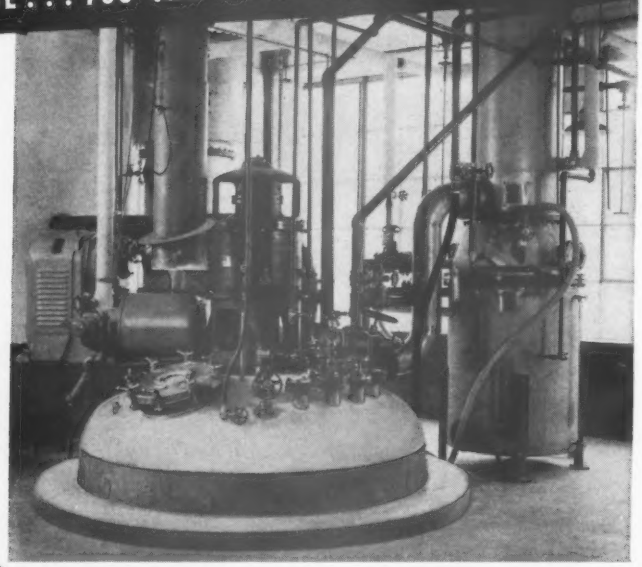

Wherever Brighton synthetic Resin Kettle Reactor has been installed, lower costs per gallon in the production of synthetic resins have justified the modernization of plant facilities. Operational charts indicate less cooking time, clearer alkyds, better quality, uniform viscosity. Because Brighton's synthetic Resin Kettle Reactor, adaptable to Solvent or Fusion cooking is automatic, you can better control your production and inventory.

Write for complete information on "Synthetic Resins, How To Do It Yourself."

* Recent installation, Automatic Radiant Gas Fired Resin Kettle with solvent reflux Condensor and Decanter.

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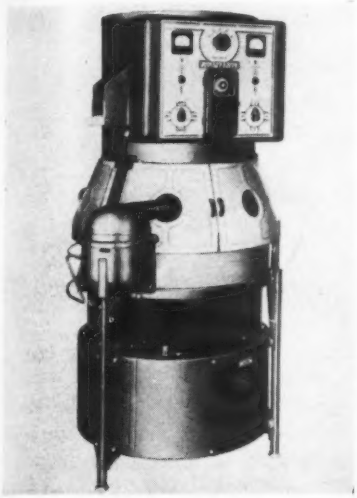
NEW MATERIALS — EQUIPMENT

drying or other paint characteristics.

It is packaged in 5, 10, and 55 gallon containers of 40 lb., 100 lb., and 475 lb. net weights.

Gallowhur Chemical Corp., Dept. PVP, Ossining, N. Y.



ATLAS ELECTRIC

FADING TESTER
With Atomizer & Meter

Fade-Ometer, Model FDA-RC, has been introduced.

This Fade-Ometer is equipped with an electrically operated atomizer and cycle meter. This permits it to be operated either under conditions simulating the cycling effect and high humidity conditions encountered in the daylight exposure method or under conditions which produce good correlation with the sunlight exposure method where samples are exposed to sunlight between 9 a. m. and 3 p. m.

Atlas Electric Devices Co., Dept. PVP, 4114 N. Ravenswood Ave., Chicago 13, Ill.

SHORT OIL ALKYD
Weather Resistant

Development of a short oil, nondrying alkyd resin, claimed so resistant to weathering that automotive finishes made with it will retain their original color and gloss for years, has been announced.

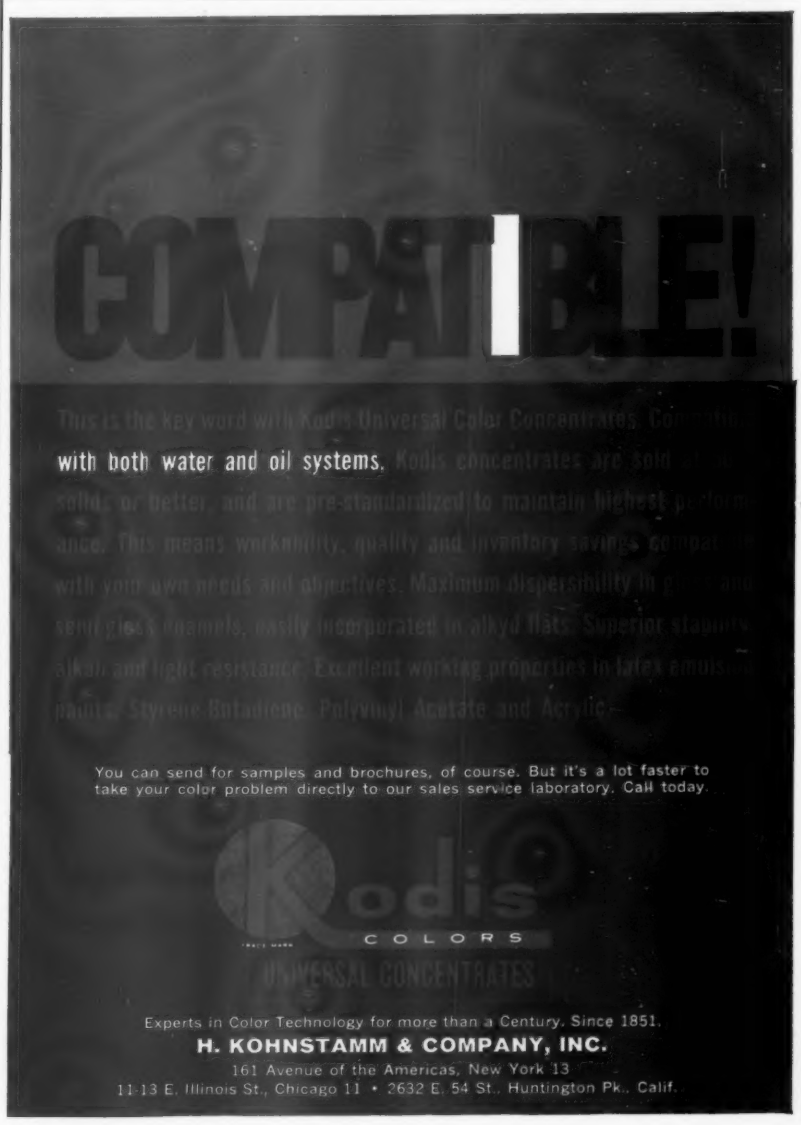
In addition to maximum weather durability, color and gloss retention, enamels and lacquers based on Aroplaz 2580-X-60 possess high hardness and good flexibility. Enamels formulated with the resin said to have excellent "hot hardness," toughness and resistance to marring and scratching.

Although designed specifically for baking enamels requiring superior weather resistance, Aroplaz 2580-X-60 also improves the weather durability of nitrocellulose lacquer finishes. As a lacquer plasticizer, the resin may be used in high concentration without reducing hardness below acceptable levels. Improved gloss and color retention and greater resistance to cracking and checking from weather exposure are obtained.

For appliance finishes, Aroplaz 2580-X-60 provides excellent hardness and color retention, permitting greater choice in the type and amount of melamine resin used.

Based on a recommended enamel formula with a 30 per cent melamine level, Aroplaz 2580-X-60 shows a Sward hardness of 30 when baked 20 minutes at 200°F. A 30-minute bake at the same temperature raises the Sward hardness to 36 and 40 minutes to 40. At 300°F, a 20-minute bake produces a hardness of 48 and 40 minutes increases the hardness to 50.

Again using a recommended white enamel formula, Aroplaz 2580-X-60 has a flexibility rating of 10 per cent on the GE Impact Tester after a 15-minute bake at 300°F and 2 after baking for 24 hours at the same temperature.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NEW MATERIALS — EQUIPMENT

Resin and Plastics Division, Archer-Daniels-Midland Co., Dept. PVP, 700 Investors Building, Minneapolis 2, Minn.

VARNISH
Fungicidal, Insulating

A clear, fast air-drying insulating varnish, said to protect electrical and electronic equipment from fungus attack, has been developed.

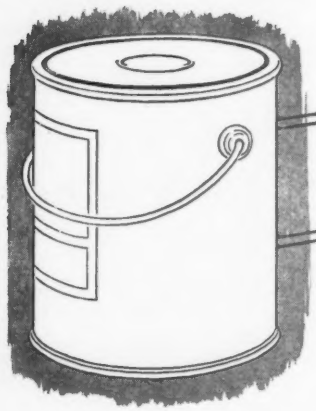
Designated No. 642-AF Fungicidal Insulating Varnish by the firm, it is applied to the surface of instruments, transformers, printed circuits, ceramic resistors, insulators and other electronic equipment subject to fungus attack in hot, humid climates.

Application of the new varnish to the surface of such equipment prevents the growth of fungus which causes surface leakage and potential arc-over paths. Failure of shipboard, aircraft and ground installation equipment which must operate in the tropics is thus minimized.

No. 642-AF Varnish is water white in color, will not "after-yellow" and is, therefore, ideal for application over stamped or painted identifying numbers, it was said.

Schenectady Varnish Co., Inc., Dept. PVP, Schenectady, N. Y.

Solve your problems



O.K. FOR SHIPMENT

before they reach the can

Baker's high-quality additives, THIXCIN® and M-P-A®, are basic insurance for a high-quality paint.

When your paint contains one of these Baker additives, you insure no settling . . . no sagging. You also insure flow control and easy brushing.

THIXCIN® . . . the superior additive for paints processed at moderate temperatures and employing low KB solvents and oil vehicles. M-P-A . . . the non-seeding additive for processing at higher temperatures, effective with all solvents.

These additives were developed solely by Baker. No other additives are backed by the same know-how, experience and service. Ask the paint man who uses them.

6644

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ESTABLISHED 1857
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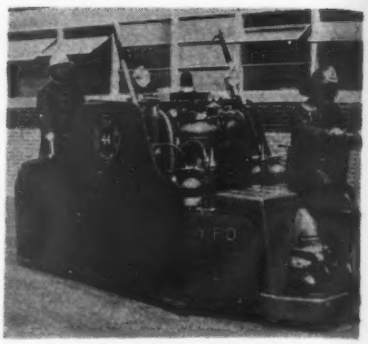


YALE & TOWNE

LIFT TRUCK
Doubles as Fire Fighter

Dual use of a low lift platform truck, as a production tool and a piece of mobile fire fighting equipment, has been effected.

Key to the system is a fire fighting unit mounted on a skid. Unit carries carbon dioxide and dry chemical fire fighting systems, as well as a small tank of water and auxiliary hose for connection to local outlets.

In case of emergency, the low lift platform truck picks up the skid and carries it rapidly to the location where it is needed. The truck designated for handling the fire fighting unit is a standard 66 inch platform Worksaver with a 24-volt electrical system permitting speeds up to 10 miles per hour. The truck has the additional advantage of maneuvering in narrow aisles, low headroom areas and other places where standard fire fighting equipment could not operate.

The Yale & Towne Manufacturing Co., Dept. PVP, 11,000 Roosevelt Blvd., Philadelphia 15, Pa.

MOISTURE DETECTOR
Simple Operation

Moisture Detector, Model BD-4, designed specifically for the painter, now available.

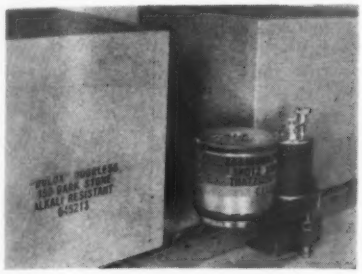
The meter is ready to operate as soon as the switch is turned on and electrode applied to wood or masonry material under test. Warning light flashes when surface is too wet to paint.

Tests wood, plaster, brick, concrete, wallpaper, acoustic tile, linoleum, and floor tile prior to application of paint. Prevents blis-

tering and peeling of paint and other decorative finishes.

The Moisture Detector is also used for analyzing the cause of paint failure and to prove that moisture is the cause and not the quality of the paint or the workmanship in application.

Delmhorst Instrument Co., Dept. PVP, 655 Cedar St., Boonton, N. J.



GOTTSCHO

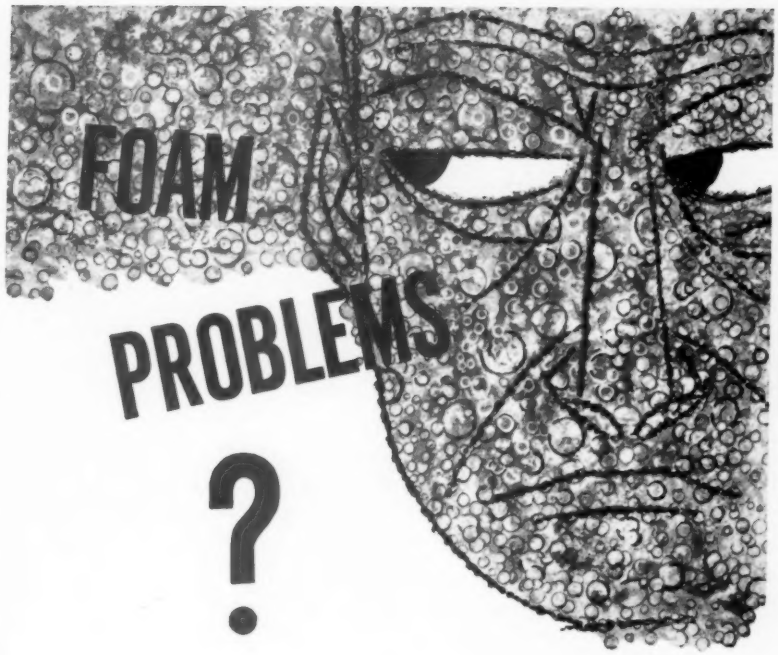
DIEWHEEL
Removes Lines Quickly

A "zip-change" printing drum or diewheel that permits entire lines of copy to be removed and replaced in seconds, has been developed for use in the firm's recently re-designed line of "Rolacoder" case-marking attachments.

The new diewheel, which is designed to accomodate "zip-change" brassback rubber dies, also allows any individual line to be changed without disturbing other lines and affords positive assurance against type shifting or falling out of place.

This development makes it practical to use an automatic marker for addressing shipping cases as well as for other applications where one or more lines of copy must be changed frequently.

The "zip-change" diewheel has a vertical line of fixed posts at one position and a line of spring-loaded posts at another position. Dies, equipped with brass eyelet fasteners at both ends, are simply slipped on or off the posts as desired. The "zip-change" dies are made in logotypes of complete wordings, as specified by the user, or with a channeled face designed to receive individual letters or figures. Both types of die may be combined on the diewheel to provide maximum versatility.



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for butadiene, acrylic, PVA base paints.

Eldefoam 400
for Polyvinyl acetate paints, especially where "fisheyes" present a problem.

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Minneapolis: M. H. Baker Company
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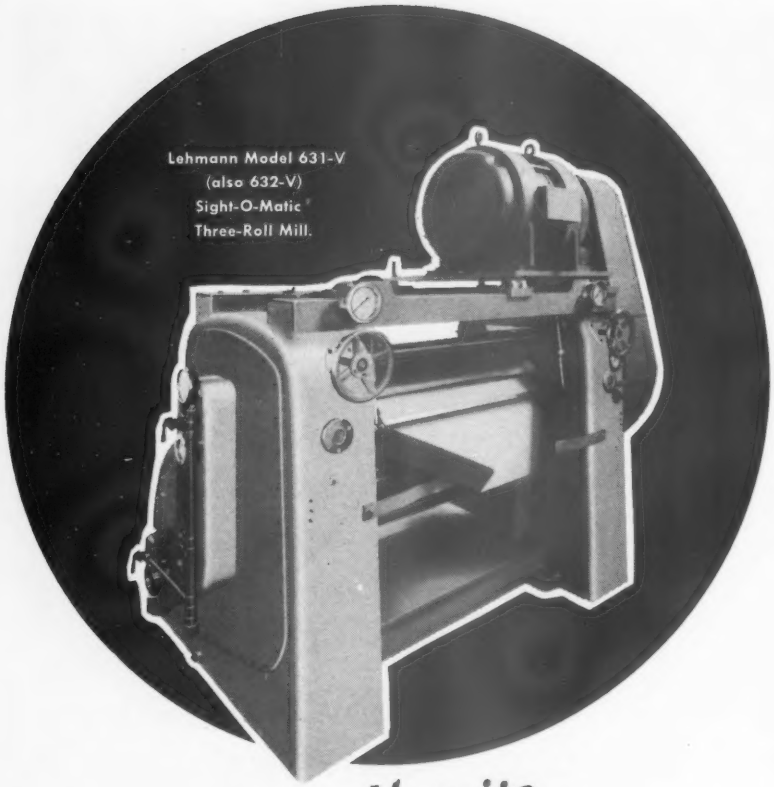
Oakland: Foremost Food & Chemical Co.
Oklahoma City: Rullman Brothers
St. Louis: Harry A. Baumstark & Company



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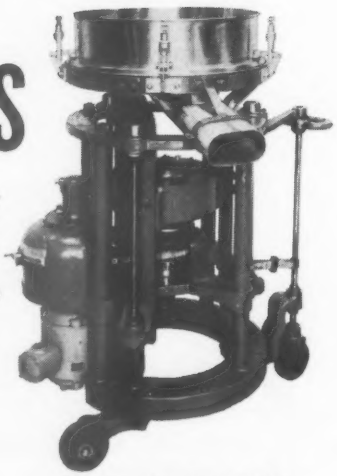

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J. M. Lehmann Co., Inc., Lyndhurst, New Jersey

NEW MATERIALS — EQUIPMENT

Adolph Gottscho, Inc., c/o David E. Rothschild, Dept. PVP, 222 E. 46th St., New York 17, N. Y.

YELLOW PIGMENT
For Protective Coatings

A clean primrose shade yellow pigment, Strontium Chromate 12170, has been made available.

The principal use for Strontium Chromate 12170 is in metal protective coatings, as its rust inhibiting properties are said to prevent the corrosion of steel, aluminum and magnesium. Strontium Chromate is only very slightly soluble when used in a primer, but sufficiently so to yield an adequate concentration of inhibiting ions to metal surfaces, thus retarding corrosion.

The outstanding property of Strontium Chromate 12170 is claimed to be its low reactivity in high vehicles, such as catalyzed epoxies. It produces little or no increase in body in such vehicles, whereas Zinc Chromate produces serious body increase in high acid vehicles. In many cases, formulators have found that an ideal combination of properties can be obtained with mixtures of Strontium Chromate and Zinc Chromate.

Pigment, Color & Chemical Division, Sherwin-Williams Co., Dept. PVP, 260 Madison Ave., New York 16, N. Y.

PHTHALOCYANINE BLUE
Improved Green Shade

A green shade phthalocyanine blue pigment, Cyan Blue GT 55-3295, has been introduced.

Cyan Blue GT 55-3295 demonmonstrates excellent dispersibility and rapid strength development in a wide variety of dispersion processes in inks, paints, plastics and floor coverings. In each case, the new pigment develops good color strength and maintains its bright green shade even in high temperature curing processes.

This new blue colorant also is claimed to have excellent acid and alkali stability, lightfastness and durability. American Cyanamid Company, Pigments Division, Dept. PVP, Bound Brook, N. J.

PATENTS

Complete copies of any patents or trade-mark registration reported below may be obtained by sending 50c for each copy desired (to foreign countries $1.00 per copy) to the publisher.

Film Forming Aqueous Colloidal Dispersions

U. S. Patent 2,863,843. Charles R. Scott and Paul A. Wolf, Midland, Mich., assignors to The Dow Chemical Co., Midland, Mich., a corporation of Delaware.

An aqueous colloidal dispersion comprising (1) a synthetic latex containing in the disperse phase a polymer obtained by polymerizing an olefinically unsaturated monomer containing in its structure at least one ethylenic group having the $CH_2=CH-$ linkage wherein said ethylenic group is joined to an atom selected from the group consisting of carbon and oxygen and (2) from about 0.25 to 5 percent by weight based on the weight of solids present in the synthetic latex of a water-soluble condensation product of from 1.5 to 3.5 molecular proportions of formaldehyde with one molecular proportion of an aliphatic polyamine having the general formula

$$H_2N-(-C_nH_{2n}NH-)_x-H$$

wherein n is an integer of from 2 to 3, inclusive, and x is an integer of from 1 to 4, inclusive, wherein the condensation is carried out while maintaining the temperature of the reaction mixture below about 50° C.

Liquid Phenolic Resins

U. S. Patent 2,862,910. Louis M. Higashi, and Reino A. Jarvi, San Jose, Calif., assignors to Monsanto Chemical Co., St. Louis, Mo., a corporation of Delaware.

A process for preparing a liquid phenolic resin which comprises (1) condensing 1 mol of a monohydric phenol with from 0.8 to 3 mols of formaldehyde in the presence of 0.002 to 0.10 mol of a catalyst taken from the group consisting of lithium oxide, lithium hydroxide, lithium hydroxide monohydrate and lithium carbonate and in the presence of sufficient water to yield a 50-70% solids end-product, said condensation being carried out under reflux at temperatures of 30-90° C. at reduced pressure, until the free formaldehyde content is less than 5% by weight, (2) thereafter cooling the reaction medium rapidly to less than 30° C., (3) neutralizing the cooled reaction

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medium with orthophosphoric acid to a pH of 7.0-7.2, whereby a crystalline precipitate is formed, and (4) filtering the reaction medium.

Wire-Coating Enamel

U. S. Patent 2,864,785. Malcolm Charlton, Cleveland, Ohio, assignor to American-Marietta Co., Cleveland, Ohio, a corporation of Illinois.

A wire coating enamel comprising a major proportion of solvent and a minor proportion of a composition comprising as the essential resinous ingredients thereof (*a*) a polyvinylal resin and (*b*) a phenol-aldehyde resin formed from the condensation of at least 0.1 and not over 0.6 mol of formaldehyde with 1.0 mol of a reactive cresylic acid selected from the group consisting of meta cresol and mixtures of meta-cresol and para-cresol containing less than about 2% of less reactive phenolic bodies, the ratio by weight of (*a*) to (*b*) being between about 2 to at least about ½ and about 2 to about 2¼.

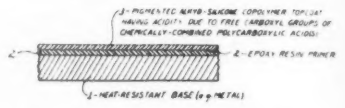
Paint Containing Aluminum Leaf

U. S. Patent 2,865,776. Thomas Rehner, Hallein, and Paul Hartmann, Vienna, Austria, assignors to Walter Marx & Co. K. G., Hallein, Austria.

A cover paint suitable for use as a protective coating over a base layer of rust-protecting paint, and comprising a uniform dispersion of aluminum leaf particles in a paint vehicle, said aluminum leaf particles having a mean longitudinal dimension of 5 microns and a maximum longitudinal dimension of 10 microns and a thickness of from 0.01 to 0.1 micron, the specific surface area of said aluminum leaf particles being from 70,000 to 90,000 square centimeters per gram, the weight of said aluminum leaf particles in the dispersion constituting a small fraction of the weight of the paint vehicle.

Epoxy, Silicone-Alkyd Coating System

U. S. Patent 2,864,722. Ronald L. Millar and Norman G. Peterson, Chicago, Ill., assignors to The Glidden Co., Cleveland, Ohio, a corporation of Ohio.


3-PIGMENTED ALKYD-SILICONE COPOLYMER TOP COAT HAVING ACIDITY DUE TO FREE CARBOXYL GROUPS OF CHEMICALLY-COMBINED POLYCARBOXYLIC ACIDS
2-EPOXY RESIN PRIMER
1-HEAT-RESISTANT BASE (e.g. METAL)

U. S. Patent No. 2,864,722.

The method of preparing an article having a durable protective two-coat coating thereon, which comprises: providing a base article which is to be coated and which is capable of withstanding the baking temperatures used to convert the hereinafter-defined applied coatings to a protective coating system; applying to said base a priming coat comprising as the sole film-forming material therein a resinous moiety composed of at least one polymeric polyether derivative of polyhydric phenol, said derivative having alternating aromatic and aliphatic nuclei united through ether oxygen, having terminal epoxy groups and being free of functional groups other than epoxy and hydroxyl groups; baking said base and applied priming coat sufficiently to convert said priming coat to a film which is incompletely cured but which is non-tacky at atmospheric temperatures; then applying on said non-tacky priming coat a pigmented top-coat having a thickness of at least 0.5 mil and comprising as the principal film-forming material therein at least one homogeneous resinous alkyd-silicone copolymer containing polycarboxylic acid which has been chemically combined therewith without consuming all of its carboxyl groups, thereby to provide a principal film-forming material having at least a small amount of carboxyl groups available for reaction with the film-forming material of said primer; and thereafter baking said base and its applied priming and top-coats sufficiently to bring about chemical reaction of carboxyl groups of the top-coat with said priming coat and thereby to convert the two coats to a protective coating system.

Urethane Coatings

U. S. Patent 2,866,722. Herbert Gensel and Wilhelm Tischbein, Leverkusen, and Erwin Windemuth, Leverkusen-Bayerwerk, Germany, assignors to Farbenfabriken Bayer Aktiengesellschaft, Lever-

Why these successful paint companies prefer MILTON cans

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kusen, Germany, a corporation of Germany.

A process for producing foamed plastic coatings on a substrate, which comprises initially applying to said substrate a composition comprising a polyester containing hydroxyl groups, an accelerator and water and effecting a foaming reaction with said composition by spraying onto said composition a polyisocyanate.

Aqueous Coating

U. S. Patent 2,865,878. Frederick W. Toothill, Jr., Abington, and Joseph A. Stieber and Harold L. Hatton, Philadelphia, Pa., assignors to Rohm & Haas, Philadelphia, Pa., a corporation of Delaware.

An aqueous composition comprising (1) a water soluble salt of an approximately 1:1 mol ratio linear copolymer of maleic anhydride and a branched-chain unsaturated hydrocarbon of 4 to 10 carbon atoms selected from the group consisting of aliphatic monoolefins and unsaturated terpenes, said salt being obtained by the addition to the aqueous copolymer dispersion of a substance selected from the group consisting of ammonium hydroxide and volatile, water-soluble amines to neutralize acid-containing units in the copolymer and having an average molecular weight of about 500 to 5000, and (2) a water-insoluble ethylene oxide condensate of a higher alkylphenol containing an average of from one to five oxyethylene units and in which the alkyl group has 8 to 18 carbon atoms, the weight ration of the copolymer salt to the condensate being from 1:2 to 5:2 and the total weight of the copolymer salt and condensate being at least 5% by weight of the aqueous composition.

Copper Conductor Coated With Silicone Resin

U. S. Patent 2,864,728. Albert J. Predota and Harry J. Kiefer, Cleveland, Ohio, assignors to The Glidden Co., Cleveland, Ohio, a corporation of Ohio.

A copper conductor coated with a heat-hardened synthetic resin coating of the double-build class, the resin solids of which comprise at least 20% resinous silicones and about 1-20% by weight on said silicones of at least one amine selected from the group consisting of triethanolamine, phenyl-beta-naphthyl amine and butoxy methyl melamine.

Protective Backing Compositions for Mirrors

U. S. Patent 2,867,538. Arthur Bienenfeld, Chicago, Ill.

A sprayable composition for the protective backing for the silver coating of a mirror consisting essentially of 48% of paraffin, 5% of triethanolamine to provide an emulsifier resulting in wide dispersion of the wax, 1% of phenol to provide a stabilizer and preservative to maintain proper suspension of the wax and to protect it against deteriorating influences and 46% of water, said composition having been agitated into an emulsion, said emulsion sprayable with a compressed air type of spray gun on the silver coating of a mirror for regular and uniform application, said water adapted to evaporate to leave the applied backing hard, durable and moisture-repellent, to protect the silver coating from moisture and other corrosive effects in the atmosphere.

Air Drying Epoxy Wrinkle

U. S. Patent 2,867,591. Burton E. Lederman, Dayton, Ohio, assignor to Midland Chemical Corp., Dayton, Ohio, a corporation of Delaware.

The process of preparing a coating composition adapted to be applied to a surface and dried to a wrinkle finish, said process comprising mixing, in parts by weight, 50 to 100 parts polymeric condensation product of bisphenol and epichlorhydrin having a 1,2 epoxy equivalency between 1 and 2, and 30 to 75 parts drying oil fatty acid, heating the mixture to a temperature of 380 to 540°F. until esterification is completed, thinning the resultant resinous mass with xylol thinner to provide a resinous vehicle having 50% solids content, introducing pigment in the amount approximating about 6 parts pigment to 100 parts of said resinous vehicle, 5 to 7 parts oil soluble metal drier, and adding thereto 15 to 20 parts of a polyalkylene polyamine to accelerate the drying of the coating composition to a hard wrinkle film.

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TECHNICAL Bulletins

PUNCHED CARD SYSTEM

A new, low-cost system of punched-card data processing specially designed for small business is described in a folder published by Remington Rand Univac Division of Sperry Rand Corp., Dept. PVP, 315 Fourth Ave., New York 10, N. Y.

The new system makes it possible for small companies, or branches and plants of larger ones, to machine process such accounting work as: production control, payroll, inventory control, accounts receivable and sales analysis.

The brochure (UI638) outlines the four basic pieces of equipment — the alphabetical punch, sorter, alphabetical tabulator and summary punch, and reproducing punch. The system operates at a speed of 60 cards-per-minute, and can be adjusted to perform faster.

DUST & FUME CONTROL

A 24-page illustrated application handbook, Bulletin 562-D, entitled, "Industry Relies on Dustube Collectors for Efficient Dust and Fume Control" is currently being offered by Wheelabrator Corp., Dept. PVP, 1231 South Byrkit Street, Mishawaka, Ind. This book describes a wide range of industrial dust and fume producing processes that can be successfully controlled with the properly designed cloth or glass bag-type dust collectors.

The operating principles of dustube collectors are fully illustrated and explained. In addition to this, 14 separate illustrated sections show how these dust collectors are currently being successfully used in a wide variety of applications.

Custom-built baghouses are illustrated to show the flexibilities of design possible to solve any specific dust and fume control problem.

There is a special section devoted to Ultra-Filtration—the high-efficiency, low-cost air filters widely used by industry where valuable instruments, electrical equipment, motor rooms, laboratories, research areas, etc. demand normal atmospheric air that is cleansed of all bacteria and sub-micron sized impurities.

ANALYSIS SYSTEM

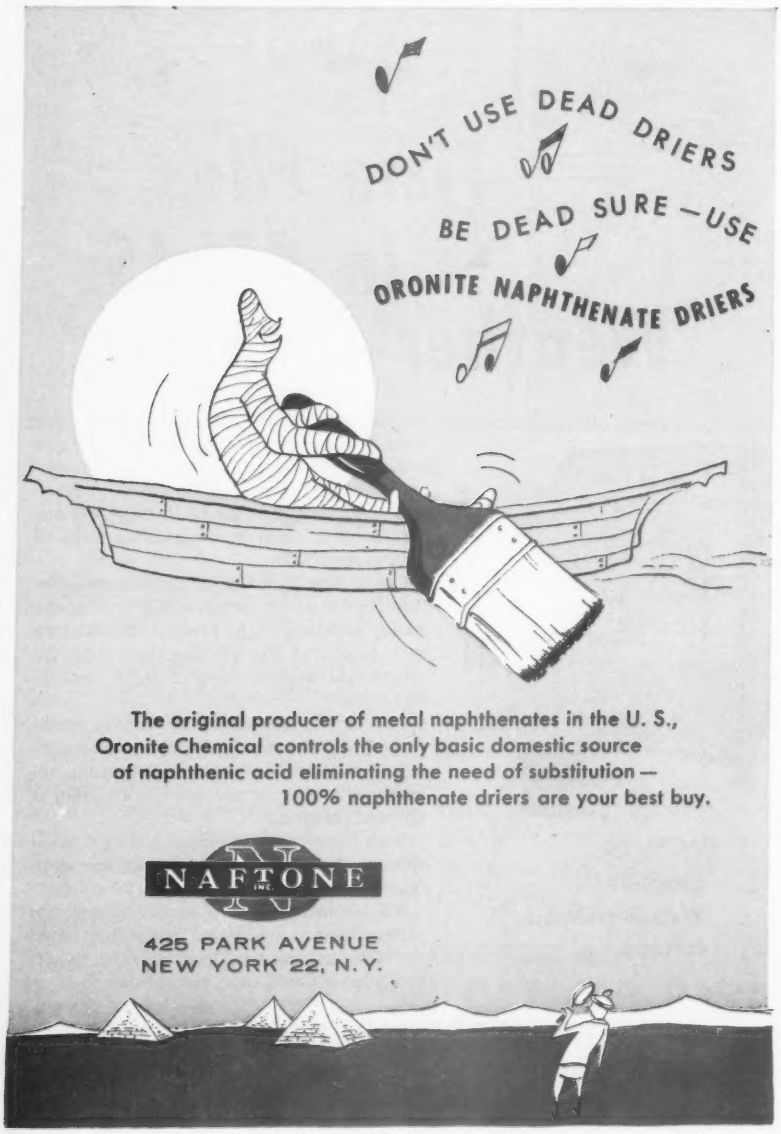
An eight-page brochure, available from Technicon Controls, Inc., Dept. PVP, Chauncey, N. Y., describes the AutoAnalyzer, an automated system for continuous chemical analysis that can analyze trace materials down to parts per billion, and continuously record results with an accuracy of 1%.

It shows how the compact system automates analytical procedures in the laboratory and controls product quality in the plant. Principles of operation and the system's new concept that automates each step of manual analysis and eliminates absolute measurements are detailed.

Complete description of the system's components are given. Industrial applications are listed as well as specific analysis for a wide variety of trace materials. A special section is devoted to water analysis.

MINERAL FILLERS

A basic study of the characteristics and applications of diatomite mineral fillers is provided in Dicalite Technical Bulletin E41 released by the Mining and Mineral Products Division, Great Lakes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NEW YORK 22, N.Y.

Carbon Corp., Dept. PVP, 612 So. Flower St., Los Angeles 17, Calif.

Bulletin supplies technical data on uses of diatomite mineral fillers in paints and varnishes.

The 12-page brochure includes an interesting history of diatomite and an examination of the characteristics of diatomite fillers (chemical properties, density and bulking effects, particle structure, surface area, porosity and absorptiveness, heat conductivity and heat resistance).

FLUORESCENT PAINT

Recently publicized tests by the Civil Aeronautics Administration proving that fluorescent paint makes an aircraft easier to see in daylight are discussed in a technical report for sale by the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. Price is $.50

According to CAA, use of this paint should help pilots avoid collisions, especially at low altitudes near airports where most mid-air collisions have occurred.

Blaze orange fluorescent paint was used with a special paint scheme. Against almost every background, a painted plane was much more discernible in daylight than an unpainted aircraft. This was especially true in overcast conditions and at short distances with the ground as a background.

Sweep beam lights and solar reflectors were also tested by CAA. Sweep-beam lights of at least 500,000 candlepower in the nose of an aircraft improved head-on conspicuousness. With solar reflectors, it was not possible to attain satisfactorily flash frequency and effective range and still obtain omnidirectional coverage.

The report is designated PB 151234, *An Investigation of Some Means to Improve the Daytime Conspicuity of Aircraft.*

ORGANIC CHEMICALS

Emery Industries Inc., Dept. 5-PVP, Carew Tower, Cincinnati 2, Ohio, offers a new edition of its catalog, listing product designations, descriptions, and specifications for its line of organic chemicals.

Included for the first time are the metholene fatty acid esters, as well as other individual products that have been added during the past year.

Other organic chemicals that are covered in the brochure are empol dimer acid, emerox azelaic acid, emfac pelargonic, capric, and caprylic acids, emolein esters for synthetic lubricants, plastolein plasticizers, twitchell fat splitting reagent, and twitchell and emersoft textile chemicals.

WATER DISPERSIBLE PROTEIN

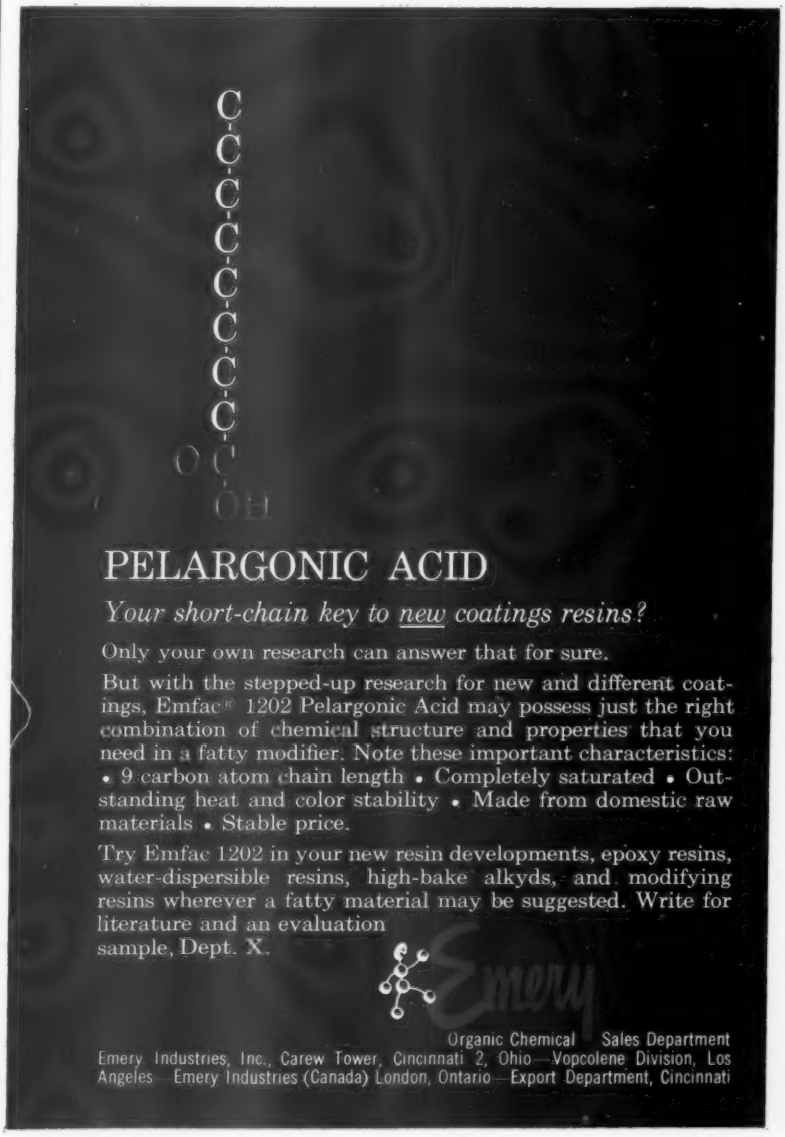
Corn Products Sales Co., Dept. PVP, 17 Battery Place, New York 4, N. Y. is offering a new 20-page booklet entitled "Zein—A Versatile Protein for Industry," which describes the characteristics and uses of Argo Brand Zein G200.

The booklet features a glossy cover protected by spirit varnish made with the new alcohol soluble, water dispersible protein.

The text gives several examples of industrial applications previously barred to most proteins which are now being profitably exploited with Zein. It describes characteristics of Zein formulations based on organic solvents, and advantages of water dispersions of Zein.

Separate sections discuss the use of Zein in specific applications such as protective and decorative coatings, and shellac replacements.

Typical formulations are given for each major application.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Emery Industries, Inc., Carew Tower, Cincinnati 2, Ohio—Vopcolene Division, Los Angeles—Emery Industries (Canada) London, Ontario—Export Department, Cincinnati

LINSEED OIL

A brochure containing linseed oil data has been made available by the National Flaxseed Processors Association, Dept. PVP, 6132 Forest Glen Ave., Chicago 46, Ill.

Information on Linseed Oil—*House Paint Primers, White House Paint, One Coat House Paint, Calcium Carbonate Tint Base, Flat Shake and Siding Paint White or Light Tint Base, Flat Shake and Siding Paint Deep Brown,* and *Flat Shake and Siding Paint Medium Green,* is given.

SILICONE INTERMEDIATES

A 12-page data sheet describing four Union Carbide silicone intermediates is available by writing to Silicones Division, Union Carbide Corp., Dept. PVP, 30 East 42nd Street, New York 17, N. Y.

These intermediates, XR-820, XR-822, XR-830 and A-183, are used by chemical, resin, and plastics manufacturers and others to modify organic resins or compounds, generally to improve heat and weather resistance. They can be reacted with alkyds, epoxies, isocyanates, phenolics, some sugar alcohols and a variety of polyols in the standard equipment used for organic resin synthesis.

HAND TRUCKS

Complete specifications and a full description of operating characteristics and advantages of four high-lift, battery powered hand trucks are contained in a six-page brochure available from Industrial Truck Division, Clark Equipment Company, Dept. PVP, Battle Creek, Mich.

Machines described are "powerworker" stackers of 1500, 2000, 2500 and 3000 lbs. capacity. Charts indicate lifting heights and lift speeds of all models. Drawings show turning radius and dimensions. Photographs illustrate such features as nested, roller-type upright, demountable drive wheel, double acting safety brakes, and fingertip controls.

COATINGS

The Bee Chemical Co., Dept. PVP, 12933 S. Stony Island Ave., Chicago 33, Ill. has made available a catalog entitled, "Coatings."

Various finishes are described and their uses, application and thinning, spray and wipe application, drying, colors and effects, physical properties, and points of interest are discussed.

CALCIUM CARBONATES

A bulletin describing the use and advantages of Witcarbs in paints is offered by Witco Chemical Company, Inc., Dept. PVP, 122 East 42nd Street, New York 17, N. Y.

The bulletin describes comparative properties of Witcarb W, Witcarb Regular and Witcarb P, and offers formulations for their use in high gloss enamel, semi-gloss enamel and alkyd flat paints.

STEEL SHIPPING CONTAINERS

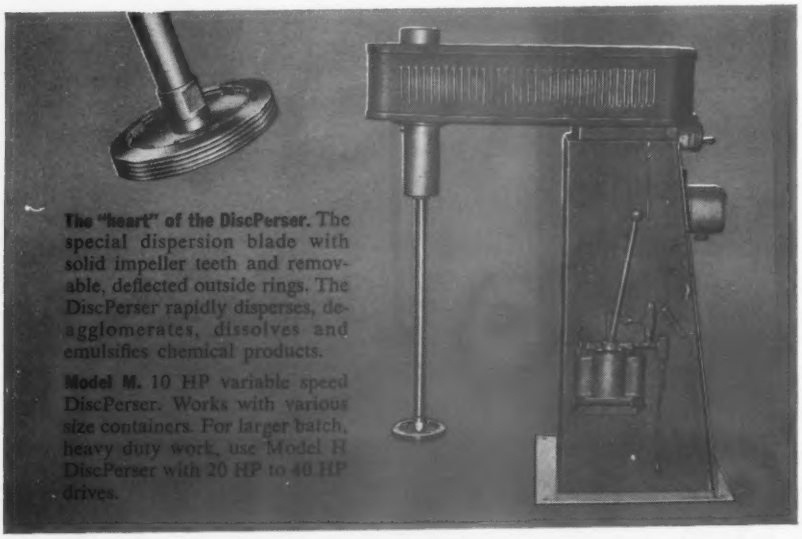
A paper, *What Should Steel Shipping Containers Weigh?* by R. S. Sawyer, has been made available.

Steel Shipping Container Institute, Inc., Dept. PVP, 600 Fifth Ave., New York 20, N. Y.

COATING RESIN

A new bulletin, Reporter No. 9, entitled "Alkydol S-1718," has been made available by the Alkydol Laboratories, Inc., Dept. PVP, 3242 South Fiftieth Ave., Cicero 50, Ill.

The bulletin includes a comprehensive description of Alkydol S-1718 polyester type coating resin, formula suggestions, and evaluation of enamels.



The "heart" of the DiscPerser. The special dispersion blade with solid impeller teeth and removable, deflected outside rings. The DiscPerser rapidly disperses, deagglomerates, dissolves and emulsifies chemical products.

Model M. 10 HP variable speed DiscPerser. Works with various size containers. For larger batch, heavy duty work, use Model H DiscPerser with 20 HP to 40 HP drives.

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The DiscPerser's special blade operates at peripheral speeds in excess of 6000 FPM. The solid impeller teeth shred and break up pigment agglomerates. Material is discharged through the slots between the rings, at great speed and under intense hydraulic pressure. Tremendous fluid hammer action is developed by the smashing of material against the surfaces of these deflected outside rings. Material leaves the blade in thin, high-speed jet streams. Impact on the slower moving surrounding material creates further attrition and speeds the breakdown to original pigment particle size.

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New Books

Index Vocabulorum Quadrilinguis
By J. J. Raaff, Chem. Docts. Published by Vereniging van Vernis-en Verfabrikanten in Nederland, Scheveningseweg 2, Den Haag. Price 95. Dutch guilders.

As a result of the growing cultural and economic unity of western Europe, it is important that the various linguistic groups should be able to understand each other to an ever increasing degree.

In a great number of technical fields, this requirement has been met by the publication of multilingual dictionaries. The urgent need for such a publication has long been felt in the paint trade, and from this point of view a paint dictionary in four languages may be regarded as a valuable vade-mecum for all such persons as have to communicate with foreign correspondents on this subject, either orally or in writing or for scientific or commercial purposes.

This work, which was originally compiled on a modest scale and duplicated in a very simple form as a tool for the paint exporter, has meanwhile grown into a collection of some 3,000 terms and expressions which the thoroughly expert compiler Mr. J. J. Raaff, chem. docts. has extracted with great patience and zeal from present-day literature in this branch of the chemical industry, at the request of the Association of Paint and Varnish Manufacturers in Holland.

The volume, which is published in a large format and is very attractively produced as regards the typography, is divided into four equal sections each arranged lexicographically according to one of the four languages: English, French, German, and Dutch.

Persons who are constantly obliged to consult international paint literature for study purposes, or have to conduct correspondence with other countries in order in promote exports, will welcome this excellent publication as being an indispensable work of reference.

Mechanisms of Inorganic Reactions

By Fred Basolo & Ralph G. Pearson. Published by John Wiley & Sons, Inc., 440 4th Ave., New York 16, N. Y. 426 pages. Price $11.75.

Written by two authors active in research, the book explores recent advances in the mechanisms of substitution reactions of metal complexes, oxidation-reduction reactions, and metal ion catalysis. Said to be the first book to apply the crystal field theory of metal-ligand bonding to problems associated with reactivity and mode of reaction of metal complexes.

The chapter on metal-ligand bonding includes a summary of all the current theories presented in such a way that the chemist can appreciate their significance and limitations in these systems.

Quality Control in Action

Published by the American Management Association, Inc., Dept. PVP, 1515 Broadway, Times Square, New York 36, N. Y. Price $3.00 (AMA members: $2.00).

This timely 116-page management report shows how a company can define the responsibilities and functions of successful quality control. Specialists describe how to plan and organize an effective quality control program, how to reduce the cost of control, how to "design" quality into the new product, and other aspects of quality control. Specific techniques are described, including how to make engineering specifications reflect consumer requirements, how to apply quality control to purchasing-vendor relationships, how to deal with shortrun quality control, etc.

This report is based on material presented on November 18 through November 20, 1957, at a special conference spronsored by the Manufacturing Division of the American Management Association.

Isotopes: A Bibliography of United States Research and Application, 1955-1957.

Published by the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. Price $2.25.

A bibliography of open-literature references to United States research into reactor-produced radioactivity and applications of radioisotopes in medicine, industry, and agriculture has just been released for industry use by the Atomic Energy Commission.

It is designed to serve as a guide to the technical aspects of isotope research and utilization.

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foreign developments

West German Paint Industry

Soviet and Polish Abstracts

Solvent selecting station at the Glasurit-Werke M. Winkelman AG plant in Hiltrup/Westf., Germany. For a discussion of recent developments of the West German paint industry, see page 99.

THE MOST VERSATILE!

Linseed Oil Outside House Paint

All through the modern development of protective coatings, ever since the original chemical investigations fifty years ago, paint people have been looking in two directions, either seeking a universal material, or in the opposite way, trying to find perfect special materials for this or that particular use.

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THE PAINT INDUSTRY IN WEST GERMANY

By
Curt R. Vincentz

WITHIN the last decade, the Federated German Republic has experienced a sustained industrial recovery, in which the paint industry has shared to the fullest extent. In fact, close analysis shows that the rate of growth in the paint industry has exceeded that of the industry as a whole in recent years. This can be explained by the fact that, as living standards for the general population have risen, and as basic economic needs have been satisfied, demand has turned toward products requiring surface treatment through paint. This is a development that took place in the United States some years before the war. Table I shows the expansion of the West German paint industry.

For the year 1958, an increase in paint production was about 5-7%. At the same time per capita consumption of lacquers in 1958 should amount to about 8kg. This total matches the standard of the highly industrialized European nations—only Sweden exceeds it. At the same time, per capita consumption in the United States is twice as high. Undoubtedly there is every prospect of a further increase in the per capita consumption of coating materials in the future. In this connection more activity is expected from the steady rise in automobile production, plus the "do-it yourself" market spurred by less working hours.

In the upward trend of the paint industry, specific raw materials have been affected. Table II shows the current consumption of various resins by the German paint industry. These figures show

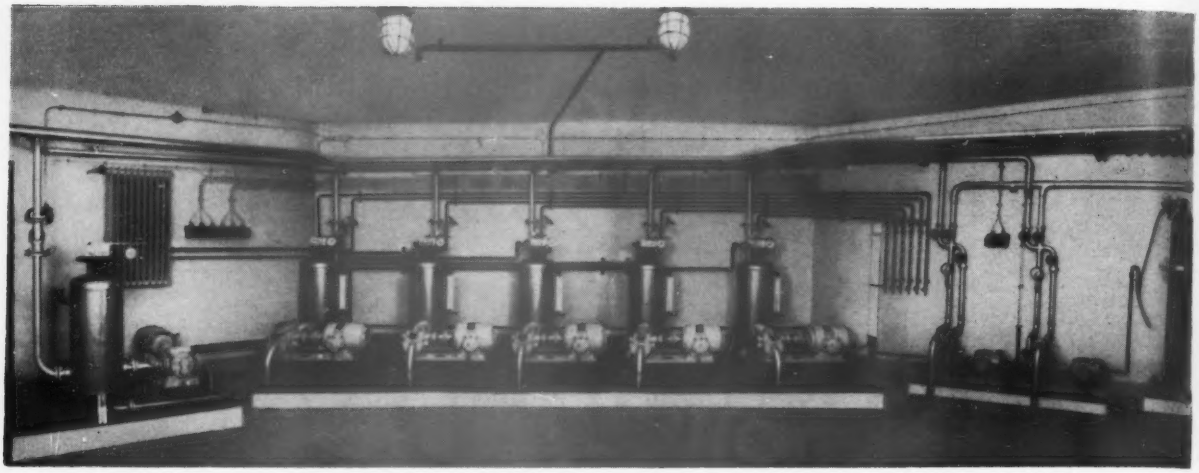
Year	Paint production in tons	Increase over preceding year
1950	182,000	
1951	207,000	13.7%
1952	219,000	5.7%
1953	238,000	8.6%
1954	272,000	14.3%
1955	311,000	14.4%
1956	345,000	10.8%
1958	400,000	9.0%

Table I. Production figures covering the period of 1950-1958.

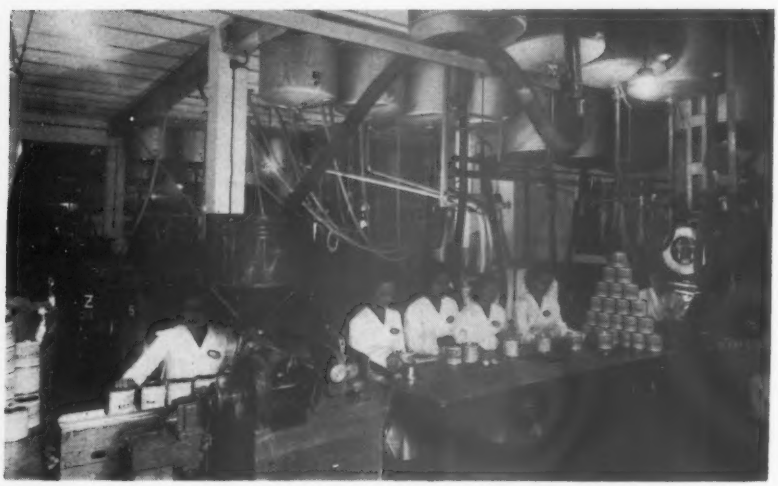
	1951	1953	1955	1957
Oil paints and oil-containing resin paints	45.6	41.5	39.6	37.1
Emulsions	4.6	5.5	5.6	6.4
Nitro- and other cellulose lacquers	17.6	16.9	17.8	17.0
Oil-free synthetic resin lacquers	5.5	6.4	6.8	7.5
Other lacquer products and thinners (not including varnishes)	26.7	29.7	30.2	32.0
	100.0	100.0	100.0	100.0

Table II. Breakdown of types of paint consumed in West Germany.

This survey of the German paint industry is based on information furnished by Curt R. Vincentz, editor *Farbe und Lack*.



Nitrocellulose dissolving units equipped with pumps at Glasurit-Werk M. Winkelmann AG.



Mechanical filling devices at Hermann Wiederhold plant in Hilden, Germany.

Shading department at the Temperol—Werke, Hamburg—Wandsbek, Germany.

that there has been an increase in synthetic raw materials at the expense of natural raw materials. Thus in the group, oil paint and oil-containing synthetic resin paints actually illustrates a shift of emphasis production-wise from pure oils to those containing one or more synthetic resinous components—a shift not demonstrable statistically, but generally acknowledged in the trade. This tendency toward an increased use of synthetic resins is confirmed by the downward trend of production of oil and lacquer varnishes, again, not illustrated in the table above.

The causes for these developments are to be sought in an increasing demand, on the part of the lacquer-using industries, for products of quality and of higher resistance. A particularly important factor is the necessity for adapting lacquer materials to production-line finishing processes (i.e., "tailor-made" products.)

Raw Materials

The Federated German Republic fortunately has at its disposal a highly developed chemical industry which, as a result of many years' experience, is especially efficient in the preparation of synthetic paint raw materials. In West Germany, particularly, production of synthetic resins has been crucially important in the de-

Transporting raw materials in cart container trains at Glasurit-Werke M. Winkelmann AG.

velopment of high-quality industrial finishes. (It is only surpassed in quantity by the United States, where production is three times greater.) The same thing holds for the mineral dyes industry, which supplies the demands of numerous foreign markets, and enjoys a very wide range of pigments. Thus, the West German finishing industry can supply domestic dealers promptly and can profit from their experience.

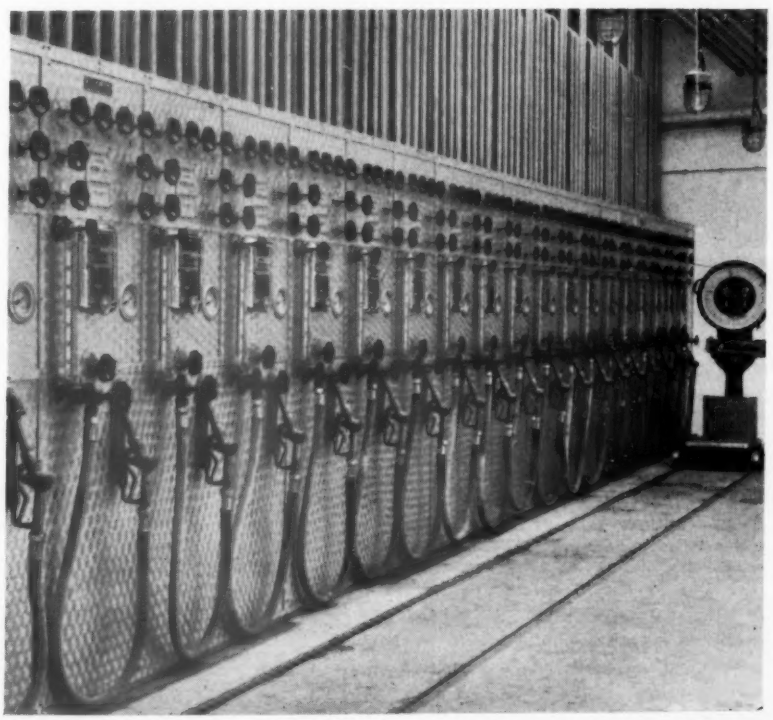
Quality Requirements

The complaint is sometimes made by German paint manufacturers that the standards of quality demanded by customers for coating materials are unrealistic. The reasons for this may lie in the fact that the population—which during the war years was supplied with materials of inferior quality—has, since then, become quality-conscious. In this connection, incidentally, buyers often demand certain finishing materials properties which are unnecessary for their particular purposes. For example, certain lacquers are required to run repeatedly over the roller-frame, when, in view of their intended application, they specifically do not call for the finest grinding. In this way the cost for mechanical processes and for raw materials, are sometimes encountered which in this age of short-life mass consumption are not justified. And German manufacturers always seek to satisfy even the most exaggerated demands of their customers.

Mechanical Equipment

The mechanical equipment of German manufacturers—not unexpectedly — differs considerably from that of American producers. The predominant machine in Germany, aside from the ball mill, is the three roller mill. The single roller mill, which seemed likely to take over the field in the first years after the war, is now used very little in paint production, while the mixing, dispersing, and solvent machines, which today play so important a role in the American industry, have never taken hold in Germany. This picture may change soon. The continuous decline in working hours and steadily increasing wages may force producers toward cost-saving production methods.

At the same time, wages in the West German paint industry amount to only 12-15% of sales, so that the problem of greater volume output per machine unit and per production worker is not so pressing as it may be some day. In this connection it ought to be mentioned that individual batches in this country are not nearly so large as they are in the United States. The very small market, and the immense variety of customer demand, as well as the comparatively unspecialized technique of manufacture, mean that small orders preponderate. In conclusion, it should be noted that large and smaller producers prepare some



Unique battery of solvent pumps. Adjacent is movable scale for solvent selection. Glasurit-Werke M. Winkelmann AG., Hiltrup/Westf.

Development laboratories of the Hermann Wiederhold firm, Hilden, Germany.

quantities of the required synthetic resins used in their own factories.

Technical Developments

The exchange of scientific ideas and development in the western world—via a good technical literature and frequent international congresses—is so active, that any new developments in one country are soon known everywhere. Similarly, the problems of lacquer production are alike in all highly industrialized countries. Thus the same problems of technical application exist in every country for similar types of lacquer. Nevertheless, certain technical developments deserve mention, because they have occurred in Germany:

1. Water-soluble, oven-dried industrial lacquers. Involved here are water-soluble phenolic or melamine resins (no dispersion) developed by Dr. H. Honel; these exhibit infinite water dilution ability (*Farbe und Lack*, 59 (1953), 174-180, and 60 (1954), 207-208). These finishing materials, in which the solvent is drained off via a water-tap, exhibit good flow, gloss, remarkable adherence to steel, aluminum, zinc and bronze, impact resistivity, good buckling strength, corrosion resistance, and chemical, heat and water stability.

2. Polyurethane lacquers. In 1937 O. Bayer (*Angewandte Chemie*, A59 (1947), 257-262; 62 (1950), 57-66; and 64 (1952), 523-531) developed the principle of polyaddition; on the basis of this, highly resistant two-component lacquers (tradenamed "Desmophen-Desmodur) were produced. These showed great value in certain fields, where other lacquers could not approach them. According to the most recent research in the Bayer factory, the Diisocyanate polyaddition process basic to these lacquers shows such good promise, that very important developments are to be expected.

3. Aluminum-organic compounds. Under the trade name "Alukone" a new type of synthetic resin, using aluminum as polymerizing structural element, has been developed. (F. Schlenker, *Farbe und Lack*, 64 (1958), 174-183). Unlike the silicones, the "Alukone" possess no metal-carbon linkage. They have interesting applications, particularly in the field of lacquer resins.

4. Unsaponifiable film forming-materials from fatty acids. J.D. v. Mikusch and K.H. Mebes have developed a process in which three or four fatty acid molecules are purified to unsaponifiable products —via treatment with a catalyst, particularly boric acid. Purification is carried out over the carboxy groups, with splitting off of 1 mole of water and .25 mole of carbon dioxide and 1 mole of fatty acid, and leads (among other things) to alkylated pyrones as end-product. Systematic research on these condensation products (known as "Unsapole") shows that they possess elevated water, alkali and acid stability, as compared with the film-material obtained from ester compounds. Aside from a certain amount of yellowing, the "Unsapole" might advantageously be used as finishing materials.

In the course of two trips organized by the writer, in cooperation with a local travel bureau, some 40 German, Swiss and Scandinavian lacquer technicians had an opportunity to learn something about American production methods. The visitors, who were received in Washington by President J. F. Battley and his staff and were briefed in the most cooperative manner on the organizational activities of his group, think back with gratitude on the personal and technical impressions they gained. They learned a good deal, and satisfied themselves (the writer included) that the manufacture, distribution and applications of lacquer in the United States is subject to the same rules of the game as apply here, even if the States do, in many areas, lead Europe.

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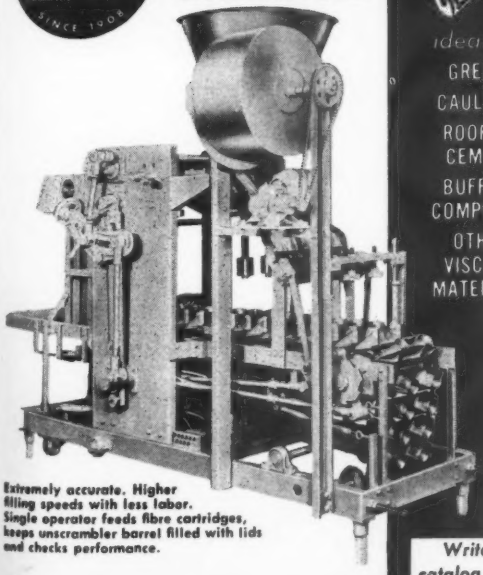

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SOVIET and POLISH ABSTRACTS

Diffusion and Viscosity of Acrylates

By V.N. Tsvetskov & S.I. Klenin, "Zhurnal Tekhnicheskoi Fiziki," 5:1019-1028, 1958.

Diffusion rate of polymer in dilute solution appears to be a direct characteristics of the size of its macromolecules; thus, if the diffusion coefficient of the polymer in solution is known, it is possible to draw conclusions as to the structure of the macromolecules. The authors describe apparatus employed in measuring the diffusion coefficients of two polymers in solution, during a comparative study of their macromolecules. The diffusion and viscosity coefficients were established for a wide interval of molecular weights. A simple relationship is proposed, permitting the determination of the macromolecular sizes of polymers in solution.

Addition of Trichlorosilane to Monoolefins

By M.G. Voronkov, N.G. Romanova, & L.G. Smirnova, "Chemicke Listy," 52:640-653, April 1958.

The authors studied thermal addition of trichlorosilane to twenty-four aliphatic monoolefins under pressure and at temperature of 280°C, resulting in appropriate alkyltrichlorsilanes. The yields were between 60 and 95 percent. The dependence of the addition-reaction rate on the structure of the initial olefines is discussed. Twenty-five alkyl- and cycloalkyltrichlorsilanes were synthesized, five of them for the first time, and their physical properties were determined. The work was carried out at the Institute of Silicate Chemistry in Leningrad.

Resinous Acids in Pinus Pallasiana Lamb

By I. I. Bardishev & Kh. A. Cherches, "Zhuraln Prikladnoi Khimii," Vol. 31, 7:1122-1124, July 1958.

Pinus pallasiana Lamb. ("Crimea Pine") contains mainly the lavo-primaric, abietic and neo-abietic acids.

Determination of Molecular Weight of Amino Plastics

By K. Dushek, "Chemicky Prumysl," Vol. 8, 6:321-324, June 1958.

An investigation of the possibility of determining molecular weights in acetic and formic acids of primary products of condensation reaction of urea, thiourea, and melamine with formaldehyde. It was determined by cryoscopic and paper-chromatographic methods that functional groups and linkages in these condensates are not stable in anhydrous acids, but undergo cleavage as well as subsequent condensation reaction. The equilibrium and kinetic data indicate the occurrence of solvolysis of methylol derivatives, which is analogous to hydrolysis in aqueous solutions. The conclusion is drawn that the determination of molecular weight of urea-formaldehyde condensation products in formic acid, as described by Walter, yields incorrect results.

Aging of Polyvinyl Chloride Pastes

By J. Zelinger & J. Franta, "Chemicky Prumysl," Vol. 8, 7:377-381, July 1958.

An investigation of the influence of usual plasticizers on the aging of PVC pastes. A rotational viscometer based on the Selsyn principle was used for viscosity measurements. The conclusion is drawn that the viscosity of pastes prepared from a mixture of plasticizers lies in the range of viscosities exhibited by pastes with a single plasticizer component.

Paste-Forming Polyvinyl Chloride

By D. Rysavy, "Chemicky Prumysl," Vol. 8, 3:153-157, March 1958.

An investigation of the suitability of PVC for the preparation of pastes, and the determination of the conditions necessary for the formation of paste-forming polymer by drying latex in spray-drier. The rate of PVC dissolution is determined by the mode of preparation. The ability of particles to form suspensions of appropriate rheological properties is primarily a function of the character of particle surface. The latter determines the degree of ability of particles to disperse in liquid phase. The nature of surface is affected mainly by the procedure used in latex drying.

Evaluation of Coal Tar Fractions

By V. Vorobjov, "Chemicky Prumysl," Vol. 8, 1:50-51, January 1958.

A method is proposed for the evaluation of xylenol and cresol fractions of coal tars, destined for resin production. The method consists of direct bromination with 0.1 $KBrO_3-KBr$ in acid methanol medium; the equivalence point is indicated by a rotating platinum electrode. The method yields reproducible results both with pure phenols and technical products. The values obtained for the average functionality (expressed as mole of bromine per mole of phenol homologue) are directly related to the behavior of raw materials during their reaction with formaldehyde. The functionality, as found experimentally, is a suitable criterion for the evaluation of raw materials.

Vinyl Chloride & Methacrylic Derivatives Copolymerization

By A. A. Berlin, L. V. Stupen, B. I. Fedoseeva, & D. M. Ianovsky, "Doklady Akademii Nauk SSSR," Vol. 121, 4:644-647, August 1958.

Experimental data on the synthesis and study of graft copolymers obtained by 1) polymerization of vinyl chloride in the copolymer latex of butylmethacrylate and methacrylic acid, 2) polymerization of a mixture of butylmethacrylate and methacrylic acid in the latex of polyvinyl chloride. The former process was carried out at varied proportions of the reagents at 45-60°C, in the presence of ammonium

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persulphate, and of the regulating agents CCl_4 or CHJ_3. The graft polymer was found to exhibit a higher Huggins constant, which indicates branching. The coefficient of reactivity of monomer and polymer points to a 60-percent monomer participation in the reaction. Higher amounts of vinyl chloride in the reaction mixture tend to increase the reactivity coefficient and the copolymer yield. The addition of regulator inactivates part of the macroradicals and results in a lower yield. Chlorine determination, characteric viscosity and titrometric titration of the copolymer were carried out; the product exhibits higher temperature of melting (changes to a viscous liquid at 190°C). Similar investigations are reported on the "reverse" graft copolymer prepared by adding a mixture of butylmethacrylate (95 parts by weight) and methacrylic acid (5 parts) to polyvinyl latex; after emulsifying the mixture for four hours at 60°C, 0.5 percent $(NH_4)_2S_2O_8$ was added; polymerization was carried out with practically full monomer conversion.

Graft copolymers of PVC and methacryl series derivatives have a major practical significance inasmuch as they combine high adhesiveness and stability to light with increased resistance to abrasion, water and oil stability, chemical resistance and non-inflammability.

Titanium Tetrachloride Reactions

By A. Lysenko & O. A. Osipov, "Zhurnal Obshchei Khimii," Vol. 28, 7:1724-1727, July 1958.

In papers published between 1952 and 1956, the authors reported that $TiCl_4$, dissolved in complex esters of monobasic acids, forms compounds of the type $TiCl_4.E$ and $TiCl_4.2E$ (where E stands for an ester molecule); compounds of the former type are stable in the liquid phase and exist in a wide temperature range. Recent work indicated that Titanium tetrachloride and esters of trichloroacetic acid and of benzoic acid form compounds of a 1:1 ratio. The existence of $2TiCl_4.E$ was confirmed. Tests demonstrated that some compounds of the $TiCl_4.E$ type decompose analogously with esters of aluminum trichloride; a yellow resin, insoluble in alcohol and ether but soluble in benzene and chloroform is a partial product of that decomposition. The conditions of decomposition were determined.

Polymerization of Divinyl Acetylene

By I. M. Dolgopolskii, A. L. Klebanskii, & D. M. Krasinskaia, "Zhurnal Prikladnoi Khimii," Vol. 31, 9:1403-1408, September 1958.

A study of the polymerization process of divinyl acetylene in the air and inert gas media seeking to clarify the effect of reaction temperature and of the concentration of divinyl acetylene in solution on the reaction rate and on the depth of polymerization at which the soluble polymer form passes into the insoluble form. The influence of inhibitors on the reaction rate and the properties of polymers was also investigated. The study resulted in the formulation of optimum conditions for the polymerization of divinyl acetylene: dilute solution (5-20 percent divinyl acetylene) in an inert gas medium, in the presence of 0.1-1.0 percent polyphenols or aromatic amines, and at temperatures from 120 to 150° C.

Synthesis of Polymer Electrolytes

By E. B. Trostianskaia, I. P. Losev, & A. C. Tevlina, "Uspekhi Khimii," Vol. 28, 9:1084-1100, September 1958.

The progress since 1953 is reviewed, and references to pertinent literature are indicated. The paper discusses the following topics: the synthesis of soluble electrolytes; the synthesis of insoluble polyelectrolytes in form of fibres; the synthesis of insoluble polyelectrolytes in form of granules (in 1957, Soviet workers determined the conditions for chloromethylating copolymers of styrene and various diene components with a maximum 74% conversion); the synthesis of insoluble polyelectrolytes in the form of membranes and elastic films. Main uses of polymer electrolytes are indicated. The bibliography refers to mostly non-Russian publications.

Polymers in the Electrical, Radio & Television Industries

By V. I. Kalitvianskii, G. V. Struminskii, & K. N. Vlasova, "Khimicheskaia

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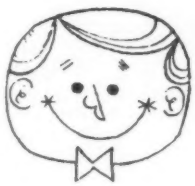

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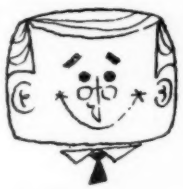

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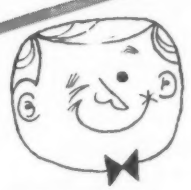

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Nauka i Promyshlennost','' Vol. 3, 3:310-320, May-June 1958.

An account of the uses of polymers in the said industries, and of their electrical properties and behavior (arranged by polymer). Organo-silicon lacquers are mentioned as being used in the manufacture of electrical insulator parts and machinery and appliances. They possess high dielectric properties in their initial state as well as after a considerably long action of water or high humidity. On prolonged heating at 200-250° C, organo-silicon lacquers undergo little change in weight; they retain satisfactory elasticity, mechanical stability, resistance to humidity, and very good dielectric properties. They are classified as Class "H" of electrical insulators.

Film Thickness Measuring Apparatus

By V. S. Aleksandrov & S. L. Epshtein, "Zavodskaia Laboratoriia," 9:1159-1160, September 1958.

Description of instrument ITP-3 designed for continuous control of thickness of films based on organic materials in density range 0.8-3 g/cm^3.

Diaryl Esters of Vinyl-Phosphonic Acid

By E. L. Gefter, "Khimicheskaia Nauka i Promyshlennost','' Vol. 3, 5:544, August-September 1958.

The synthesis took place in two steps: a) by heating dichloroanhydride of β-chloroethylphosphonic acid with various oxy-aromatic compounds (phenol, *n*-chlorophenol, 3,4-xylenol and 3,5-xylenol) in excess, and b) dihydrochlorinating the resultant mixture by heating it with triethylamine. Diaryl esters of vinylphosphonic acid were obtained with a 70-80 percent yield of theoretical; the products are colorless or slightly yellow, transparent and viscous liquids soluble in alcohol, ether, benzene, toluene but not in water. Their properties are tabulated.

Preparation of Grafted Copolymers

By V. V. Korshak, K. K. Mozgova, & M. A. Shkolina, "Doklady Akademii Nauk SSSR," Vol. 122, 4:609-611, 1958.

To devise a method of preparing grafted copolymers not leading to simultaneous formation of block-copolymers, polyamides were subjected to the action of ozone and subsequently treated with vinyl monomers (styrene and methylmethacrylate). The mechanical stability of caprone film, subjected to action of ozone, first increased, then fell off (after one hour). Subsequently, the film was submerged for 5 hrs. into styrene, then boiled for 1 hr. in benzene, and washed in cold benzene; upon examination, its mechanical stability was higher than that of the initial film, but did not practically differ from the stability of the ozone-treated film. The authors observed and tabulated the change in specific viscosity of samples of polyamides under the effect of ozone and after polymerization, and the change in elementary composition. They conclude that the process leads to the formation of a layer of polystyrene (or polymethylmethacrylate) on the surface of the polyamide film or fiber, linked chemically. The reaction mechanism is suggested.

Characteristics of Emulsion Polymerization

By P. M. Khomikovskii, "Uspekhy Khimii," Vol. 28, 9:1025-1055, September 1958.

A bibliographical review of the advances in kinetics and topochemical characteristics of emulsion polymerization, both in the Soviet Union and abroad. The 119-item bibliography carries approximately half of Russian references, through 1957. After a brief introduction, the following topics are reviewed: general remarks on the topochemistry of latex polymerization; the kinetics of latex polymerization; kinetics relationships (rate of polymerization, effect of phase ratio, influence of the nature and concentration of initiators, effect of the nature and concentration of emulsifiers, temperature dependence, molecular weight); effect of electrolytes. The end of the paper summarizes the basic topochemical and kinetic characteristics of latex polymerization.

Determination of Lacquer-Coating Hardness

By I. I. Golovistikov & V. V. Chebotarevskii, "Zavodskaia Laboratoriia,," Vol. 24, 10:1276, October 1958.

The pendulum apparatus for measuring hardness of paint and lacquer coats, manufactured by the Khotkov Experimental Plant for Paint Apparatus, operates for temperature range of 25°—90°C, and takes two hrs. to heat water to 99°C. A modification of the apparatus, devised by authors and described as MAV-2, employs infrared light, and increases the temperature range from 25°—350°C; the maximum temperature is attained within 15-20 mins. Using their apparatus, the authors established that the changes in hardness with increasing temperature vary for different lacquers. A diagram of the apparatus is shown.

Melamine, Its Properties & Methods of Preparation

By S. N. Karaznovskii & Z. N.Shvetsova, "Khimicheskaia Promyshlennost','' 6: 325-330, September 1958.

In consideration of the recent (May 1958) governmental planning decisions, the melamine industry in the Soviet Union is expected to register considerable growth in the next six years. The present paper reviews the uses, properties and methods of synthesis of melamine. References to literature are given, and the synthetic preparations of melamine illustrated by flow-sheets.

Vacuum Properties of Epoxy Resins

By E. A. Kolenko & V. G. Iur'ev, "Zhurnal Tekhnicheskoi Fiziki," Vol. 28, 10:2259, October 1958.

An investigation of some characteristics of epoxide resin (without filler, and polymerized at 140°C) under vacuum. Vapor tension was measured at temperatures of 50, 100, and 150°C. Under vacuum, polymerized epoxies appear as solids; their excellent adhesive properties permitted preparation of high-vacuum compounds with glass and other materials. Uses are suggested for epoxide resins in laboratory and electro-vacuum technology.

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TRANSITION

(*From page 27*)

therefrom will be superior to those made from the individual polymers.

In the field of industrial finishes, the desire to eliminate the fumes and fire hazard of solvent-gased coatings has steadily enhanced interest in water-based systems. By introducing sufficient polar groups in both oil-modified and oil-free alkyds, water dispersibility and even water solubility can be obtained. Several products of this type have recently become available and will be covered in greater detail during the course of this panel. It is almost a certainty that alkyds in water-based industrial finishes will grow in importance.

Solventless Coatings

While most of our discussion has been concerned with oil-modified alkyds, we have mentioned the use of hydroxylated oil-free alkyds or polyesters, crosslinked with polyisocyanates or reacted with polysiloxanes, in surface coatings. Another promising possibility for oil-free alkyds in coatings lies in the area of application by a fluidized bed technique. The use of a partially condensed polyester with a minimum average functionality of 2½ offers interesting possibilities along these lines.

The attractiveness of solventless coatings leads our discussion to a consideration of unsaturated polyesters with reactive monomers. These polyester coatings have some excellent properties, such as light color, and excellent toughness and durability. Several technical difficulties have retarded the expanded use of these materials. The use of the catalyst and accellerator requires considerable care and the pot-life of the catalyzed resin is quite short. However, the recent development of special twin-head spray guns gives promise of solving this difficulty. Air inhibition of polymerization at the air interface has been overcome, for the most part, by the use of small quantities of wax. However, the resultant coating surface has a dull film of wax, which must be removed to improve the appearance. Considerable research is currently underway to discover a means of protecting the surface of the coating from inhibition by air without the use of wax. There are two approaches to this problem—by additives or by a fundamental change in the alkyd or polyester component. Some success has been achieved in finding better additives, but it is probable that the final solution will result from new and improved unsaturated polyester structures. These coatings are attractive, not only because of their relatively low cost, but because superior results are obtained with thick coats which give long-lasting durability. This method of application is the coating technologist's answer to the use of plastic laminated surfaces. The economics are favorable, and considerable activity in this direction is foreseen.

I have attempted in this short period to indicate the amazing versatility of alkyd resins in organic coatings, both by themselves and in conjunction with a variety of other reactants and polymeric materials. This ability to form synergistic combinations is a fertile field that will continue to challenge the ingenuity of paint technologists.

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Magnesium Silicate

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Ground Pyrophyllite

PEERLESS CLAY
Domestic China Clay

THERMATOMIC BLACK
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RHEOTOL
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NEWS

NEWS OF COMPANIES, ASSOCIATIONS
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ITEMS OF GENERAL INTEREST

ASTM To Organize Materials Division

A new division on materials sciences will be organized by the American Society for Testing Materials to coordinate and intensify the development of knowledge of the fundamentals of materials.

The new division, the first to be established by ASTM, will augment in depth and scope the society's long-time objectives of promoting knowledge of engineering materials and tapping new sources of knowledge for the society's extensive standardization activities. The division will concern itself with the collection, establishment, and publication of basic information essential in creating a better understanding of materials and their properties, and especially will help to answer "why" materials are what they are.

The ASTM national directors, coming from many materials fields and industries, recognize the importance of placing more emphasis on fundamentals in view of the rapid growth of technology. Since its inception in 1898, the society has published hundreds of technical papers and outstanding symposiums dealing with problems which are fundamental to our knowledge of why materials act the way they do.

ASTM is in a unique position to provide a forum for materials scientists and engineers as its interests and long-time activities cut horizontally across the entire materials filed. Here there is common ground for the physicist, the chemist, and the engineer in a variety of fields—electrical, mechanical, civil, chemical, and many more.

The team approach representing these many disciplines is not new in ASTM as this is the way the society's 80 technical committees have functioned for many years. Research activities relating to fundamentals under way in many of the committees will continue as now organized. The new division can assist or aid in coordination.

Many feel that if the society's important work—concentrated on "Research and Standards for Materials"—is to expand and keep pace with scientific developments and provide industry with the essential data and standards needed to continue its healthy growth, there must be organized efforts on fundamentals.

This recommendation for a new division is one of several initiated by the ASTM long-range planning committee. Other developments have included an administrative committee on education in materials which has a program under way, and decisions to award certain fellowships and "grants-in-aid" for materials study.

It is expected that members of this new ASTM division will include many now active in ASTM committee work, as well as other members of the society; and invited to participate will be other leaders in science who are concerned with the basic problems involved.

Actual development of the division has been entrusted to a group of four officers—President K. B. Woods, head, School of Civil Engineering, Purdue University; two ASTM vice-presidents: F. L. LaQue, vice-president and manager, Development and Research Division, The International Nickel Co., Inc., and A. Allan Bates, vice-president of Research and Development, Portland Cement Association; and executive secretary Robert J. Painter.

In establishing the division, the directors are conscious that this might be the first step in a better coordinated arrangement of the society and its 80 operating technical committees.

•

N. Y. Club Program

The New York Pigment Club has announced its spring speaking program as follows:

March 12. *Patenting Pigment Inventions.*
Milton Zucker,
Sweedler & Zucker.

April 9. *Pigment Dispersions with Acetylene Derivatives.*
Emil A. Wich,
General Dyestuff Co.

•

Rheem Plans Transfer

Rheem Manufacturing Company has announced plans to transfer steel shipping container production from Sparrows Point to its container plant at Linden, N. J., to serve east coast market areas. The Sparrows Point plant will continue to manufacture Rheem home products items.

NEW PRESIDENT: Joseph P. Haddock, second from left, retiring president of the St. Louis Paint, Varnish & Lacquer Association, congratulates the new president of the paint manufacturers' organization, Al H. Judd, second from right. Mr. Haddock automatically became vice-president. Looking on are A. F. Voss, Jr., left, elected secretary, and A. Dave Evans , right, elected treasurer.

NEWS

Goldblatt & McKinney Research Award Winners

Recipients of the Seventh Annual Glycerine Research Awards have been announced by the Glycerine Producers' Association, New York. The awards were given in recognition of new and independent research contributing to knowledge of glycerine and its derivatives.

N. L. Glanakos, left, chairman of the Glycerine Research Committee, presents the first place honor plaque in the Seventh Annual Glycerine Research Award competition to Dr. Leo A. Goldblatt of the Southern Utilization Research and Development Division of the U. S. Department of Agriculture. In conjunction with Dr. Robert S. McKinney, also of U.S.D.A., Dr. Goldblatt synthesized tung oil monoglycerides and examined their properties as fugitive emulsifiers.

The first award of $1,000 and an honor plaque was awarded to Drs. L. A. Goldblatt and R. S. McKinney of the Southern Utilization Research & Development Division of the U. S. Department of Agriculture at New Orleans, La. for their work on synthesis and examination of the unique physical properties of tung oil monoglycerides.

The subject of a pending Public Service patent, this research has special significance since these monoglycerides have great potential for use in agricultural sprays where they function as fugitive emulsifiers.

In this capacity, these monoglycerides serve to keep the components in suspension until the material is applied to the surface. After application, they must lose their emulsifying action or the coating will be easily removed after coming in contact with rain, water or other liquids. They are also applicable for water dispersible coatings, textile finishing agents, floor waxes, roofing and paving formulations, and other commercial and emulsion formulations.

Sinclair Name Change

The name of Sinclair Chemicals, Inc., has been changed to Sinclair Petrochemicals, Inc., John A. Scott, president, has announced.

All personnel, offices and operations remain unchanged, Mr. Scott disclosed.

Underpass Rehabilitated With Duratite Finish

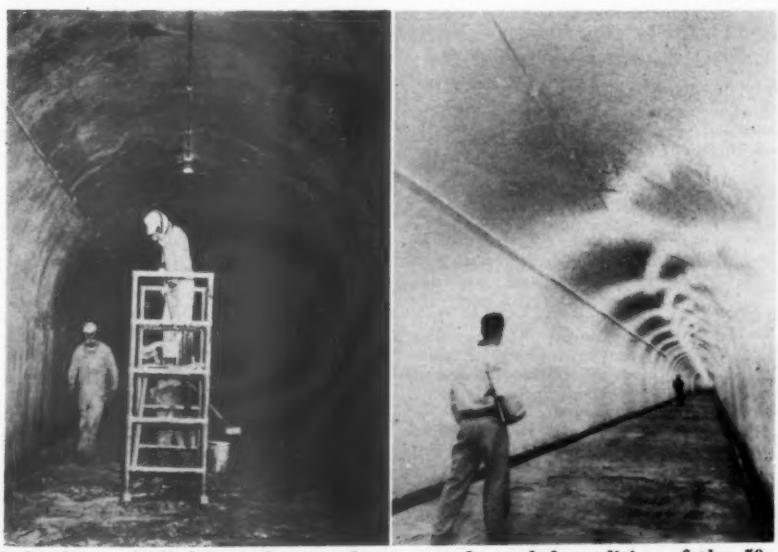
The engineering division of the Office of Borough President of Manhattan, faced with rehabilitating the 191st Street pedestrian underpass which had become eroded and discolored beyond repair after more than 50 years use, chose a special epoxy system to refinish the interior walls.

The 860 foot long tunnel was in such poor condition that engineers were considering installing ceramic tile as lining for the interior. A less expensive, but equally satisfactory alternate was an epoxy resin-based formulation. The white pigment finish, "Duratite," manufactured by Production Paints and Coatings, Inc., Brooklyn, New York and based on Ciba Araidite epoxy resins, provides tile-like protection at one-fourth the cost of ceramic tile. Enduring resistance to moisture penetration, abrasion, scuffing, and fungi are properties of the coating which will mean many years of maintenance-free service. In addition, the finish is imperious to grease, oil and fumes.

The coating is a two-part system consisting of a curing agent and a pigmented Araldite epoxy resin-based component. The two parts are mixed just prior to application, which can be done by spray, roller or brush. Only pretreatment necessary was a thorough sandblasting of the 30,000 square feet of surface. The finish cures by chemical reaction in about 24-36 hours depending on temperature.

The development laboratories at Production Paints and Coatings, Inc. formulated the system maximum visibility and reflectance to provide adequate light for the otherwise dark tunnel.

For many years to come, the only maintenance required will be a periodic washing of the coated surface with soap and water. The tough epoxy-based finish resists soap and hot detergents without any noticeable deterioration of the surface.



Left: View of 860 foot underpass shows severely eroded condition of the 50-year old concrete wall surface. The surface will be thoroughly sandblasted before application of the "Duratite" epoxy-based finish. Right: The tile-like epoxy based finish adds brightness and increased visibility to the underpass as shown in this view of the completed resurfacing job. Many years of maintenance-free service are expected.

NEWS

Southern Production Club Schedules Annual Meeting

The Southern Paint and Varnish Production Club will hold its 25th annual meeting at the Buena Vista Hotel, Biloxi, Miss., March 18-20, 1959.

Reservations should be made through the hotel for handling by the housing committee, John J. Hughes, Jr. in charge.

One of the most important features this year will be the large number of raw material and machinery exhibits.

There has been a great deal of activity by the Advisory Committee this year. All Class A members are requested and urged to hear and join the discussion of all papers. It is most important that all be at the business meeting, Friday, March 20 at 9:45 A.M. for voting on new proposals.

For all that wish to join recreational activities and attend all business sessions, a pre-convention afternoon (Wednesday, March 18th,) has been set aside. Prizes will be given by the Southern Production Club for golf and fishing.

The following program has been announced by the chairman, R. B. McGoogan, Jr.:

WEDNESDAY–March 18.
Erection of booths, installation of machinery and raw materials exhibits
8:00 A. M.–Fishing-Gulf (William N. Tune in charge)
9:00 –Convention registration opens (Herman J. Fritz in charge)
1:00 P. M. –Registration closes

THURSDAY—March 19.
8:30 A. M.–Registration desk and Raw Material Exhibits Open
10:00 –Invocation by Rev. Victor Augsburger, Minster, First Presbyterian Church, Bilexi
–Convention officially opened by President, C. B. Thomas
–Introduction of Federation Officers and Representatives
–Introduction of National Paint, Varnish & Lacquer Association Officers
(Address by Gen. Joseph F. Battley, President)
National Paint, Varnish & Lacquer Association
10:45 –"Polyvinyl Acetate Paint Formulations for Dry Wall Construction"
Dewey & Almy Chemical Co.
11:15 –"Pigment Studies"
Fred Steig, Titanium Pigment Corp.
12:00 P. M. –Adjournment for Lunch
12:30 –Luncheon for officers and executive committee with officers of federation of paint and varnish club
2:30 –Report on abrasion testing machine and results of traffic paint exposure tests
Dr. Henry Payne, University of Florida
3:30 –Causes and cure of efflorescence on painted surfaces in the south
Gerould Allyn—Rohn & Haas Co.
5:00 –Raw material and machinery exhibit closes

FRIDAY—March 20.
8:00 A. M.–Breakfast meeting of the Nominating Committee, Ross McKenzie, Chairman
8:30 –Machinery & Raw material exhibit opens
9:45 –Business meeting, Southern Paint & Varnish Production Club.
–Report of Council Representative, John Hughes, Jr.
–Committee Reports
–Election of Officers, 1959-60
11:00 –The Open Forum — General Billy Hood in charge. (Billy Hood returns again this year with his popular "Open Forum")
–Rewards for those who offer practical solutions to the problems presented—If you have a problem, write it on a card and mail or give it to Billy Hood, prior to program time
12:30 P. M. –Adjournment for lunch
2:30 –"Oil Modified Polyurethanes"
Cargill, Inc.
3:10 –"Trade Sales & Industrial Water Reducible Vehicles for the paint Industry"
Archer-Daniels-Midland Co.
5:00 –Machinery & Raw Materials Exhibit Closes
7:30 –Banquet for Ladies and Gentlemen
9:00 P. M. – 1:00 A. M.–Informal Dance

SATURDAY—March 21.
8:30 A. M.–Breakfast meeting of the Advisory Committee.

LADIES PROGRAM
THURSDAY—March 19.
12:30 P. M. –Luncheon for Ladies at the Buena Vista, followed by "The Mad Hatter"—Internationally known hat designer, lectures on hat secrets for "Milady" using ladies from the audience as her models—At the Conclusion of lecture, 3 hats from a collection of over 100 will be given away

FRIDAY—March 20.
10:00 A. M.–Escorted tour of Belingrath Gardens
7:30 P. M. –Banquet for Ladies & Gentlemen

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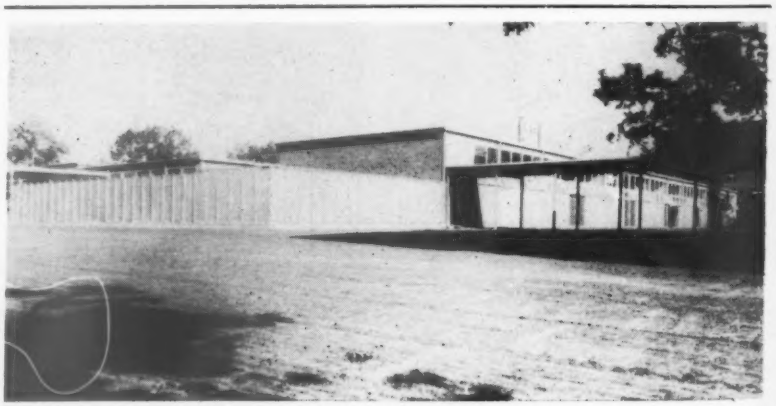
Biscayne-Gallowhur Formed

George Gallowhur, president of Gallowhur Chemical Corporation, has announced the formation of Biscayne-Gallowhur Corp. which merges the operations of Biscayne Chemical Laboratories Inc., Miami; Gallowhur Chemical Corporation, Ossining, N. Y.; Ajax Chemicals Inc., Miami; and Gallowhur Chemicals Canada Ltd., Montreal.

Directors of Biscayne-Gallowhur Corporation include Alexander Sachs, economist and a director of The Lehman Corporation; Julius Fleischmann of Cincinnati and New York; Carson McClain of E. I. duPont de Nemours and Company, and George Gallowhur. Headquarters of the new corporation will be in New York City.

The management of Biscayne, Ajax and the two Gallowhur companies remains unchanged.



CYANAMID DEVELOPMENT LABORATORY: A more direct link between its customers and company technical personnel responsible for improving plastics products has been established by American Cyanamid Co. with the beginning of full-scale operations at its new Wallingford, Conn., development laboratory. Process and product development work for its plastics and resins division is consolidated here by a staff of 70 chemists, engineers, and technicians. Laboratory dimensions are 260 feet by 160 feet; the accompanying pilot plant measures 60 feet by 60 feet. Both structures adjoin company plastic production facilities. Construction began in January, 1958.

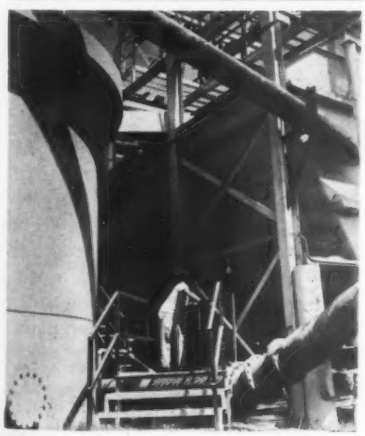
NEWS

Du Pont Opens Research Center

A new, modern research center for Du Pont's electrochemicals department was opened recently at Niagara Falls, N. Y.

Dr. Campbell Robertson, laboratory manager, said the new building will be the focal point for research and development work on products and processes vital to the department's established business in sodium, vinyl products, peroxygen compounds, nylon intermediates and related fields. In addition, laboratory personnel will pursue research leading to the development of new products.

The building itself has a floor area of 44,000 square feet and is occupied by about 100 persons. The building contains 15 laboratories, each equipped to serve two chemists, and two laboratories equipped for one each, three laboratories with special analytical equipment, a constant temperature room, lunch room, library, conference room, and offices.



PHENOLIC-BASED PAINTS: Paints, based on Bakelite phenolic resins, have successfully resisted corrosion after three years of service on a chemical plant in Florida, according to paint manufacturer, Dixie Paint & Varnish Co., Brunswick, Ga. Almost every metallic surface at the Virginia-Carolina Chemical Corporation's Clear Springs washer, in Florida, is coated with the paint. The plant produces phosphate rock for use in fertilizer and other phosphate products. In addition to resisting corrosion fumes and fading by the sun, the coating has withstood slurry spillage.

N. Y. Club Talk

Frank B. Chester, Atlantic & Gulf Equipment Corp., delivered a talk at the February 5 meeting of the New York Paint & Varnish Production Club. Mr. Chester's talk, illustrated with slides, was entitled, *Material Handling—How Does It Apply To The Paint Manufacturer.*

Frank B. Chester

Mr. Chester highlighted the following areas: *Just What Is Material Handling*, and *Approach To Cutting Costs* (receiving, raw material storage, processing, finished goods storage, shipping).

In outlining *Material Handling*, Mr. Chester discussed unit loads; palletization; containerization; equipment—hand, powered, mobile, stationary, and warehousing.

The talk was concluded with a discussion of *A Practical Approach.* Mr. Chester suggested a check list for initiating an overall material handling program.

•

Eastman Opens Offices

The chemicals division of Eastman Chemical Products, Inc., subsidiary of Eastman Kodak Company, has announced the establishment of new sales offices for its industrial and specialty chemicals in Atlanta, Ga. and Greensboro, N. C.

Located at 3133 Maple Drive, N. E., the new Atlanta office is headed by Jack T. Mahaffey.

Richard Fayssoux has been assigned to the Greensboro office of Eastman Chemical Products, located in the Jefferson Standard Building, where this division of the company presently has offices.

WATER GROUND

MICA

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HOUSE PAINTS

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FRANKLIN MINERAL PRODUCTS

COMPANY

FRANKLIN, NORTH CAROLINA

INCORPORATED 1926

Agents in Principal Cities

CLASSIFIED ADVERTISEMENTS

Rates: $.20 per word, except those seeking employment, for which rate is $.10 per word. Minimum: ten words. Address all replies to Box Number, c/o Paint and Varnish Production, 855 Avenue of the Americas, New York 1, New York.

CHEMIST WANTED

For supervising paint laboratory of medium size Eastern manufacturer making complete line of chemical-resistant coatings; 2-3 years' experience in paint laboratory required. Time available for development work. Excellent opportunity for advancement. Send resume including photo, and indicate salary desired. Box 359.

Catalyst Added to Line

Tertiary butyl hydroperoxide has just been added to the line of organic peroxides manufactured by Cadet Chemical Corp.

It is offered in commercial quantities that contain a minimum concentration of 72.0% with a deviation of only plus of minus 1.0%.

NEWS

Paint Show Scheduled For Atlantic City

The 37th Annual Meeting and the 24th Paint Industries' Show of the Federation of Paint and Varnish Production Clubs will be held in the Lower Hall of Convention Hall, Atlantic City, N. J., from October 20-24, 1959. Originally planned for the Ambassador and Ritz Hotels at the seashore resort, the success of the Paint Industries' Show in a large auditorium, rather than in a hotel, has made the change advantageous to all concerned.

The show is scheduled to run for five days, beginning October 20th. The annual meeting will open on the 23rd. Registration will begin on October 21st at the Traymore Hotel and will move to Convention Hall for the remaining three days.

The hotels to be used for accomodations will include the Traymore, Claridge, Madison, and several new and luxurious motel-style hotels. All room reservations must be made through the Atlantic City Convention Bureau. None will be made through the Federation headquarters office in Philadelphia. Applications for reservations will be mailed to all members of the Federation. Additional copies may be obtained from the Federation office.

The Federation Council will meet on October 21st at the Traymore. Other committee meetings will be announced later.

It will be "Paint Week" in Atlantic City, for, once again, the conventions of the Federation and the National Paint, Varnish and Lacquer Association will be held jointly. The NPVLA will hold its meeting from October 18-21 at the Chalfonte-Haddon Hall Hotels.

The prospectus for the Paint Show will be mailed shortly to all previous exhibitors. Judging from the number of requests received for show information, this year's show looms to be the biggest and best ever held.

The Federation's program committee, under chairman Bill Foy, has already lined up a number of informative technical and educational papers. The outstanding technical presentation will again be the Joseph J. Mattiello Memorial Lecture. The identity of the lecturer and the subject of his paper will be announced in April.

ELECTED: Herbert S. Johnson of H. Kohnstamm & Co., was elected president of the New York Pigment Club at a recent annual election of the organization.

Petrochemical Plant

American Chemical Corporation, jointly owned by Stauffer Chemical Company and Richfield Oil Corporation, has announced that it has completed plans to build a $7,500,000 petrochemical plant at Watson, California. Completion is scheduled for January, 1960.

Major products of the new petrochemical venture will include ethyl chloride, ethylene dichloride and vinyl chloride monomer. The company also plans to produce plastic polymers and co-polymers as well as perchlorethylene and trichlorethylene.

•

N. Y. Office Moved

Clarence E. Clark, president of Whittaker, Clark & Daniels, Inc., has recently announced the relocation of the company's New York office at 100 Church Street, New York City.

•

Morningstar Production

Production of liquid vinyl chloride and natural and synthetic latex compounds was recently begun at the new Clifton, N. J. plant of Morningstar-Paisley in line with an expansion of the company's latex and plastisol sales and technical departments, according to an announcement by Earl C. Lenz, sales vice president.

The new, modern plant, which includes 100,000 square feet of manufacturing space, adjoins the company's recently acquired Haberland facility.

Although the Clifton plant will produce the bulk of the plastisol, organosol and latex products in the Morningstar line, production of some of these materials is contemplated at the company's plants in Chicago and Baltimore.

•

Monsanto Anhydride Plant

Monsanto Chemicals Limited, London, England, will erect a 15,000,000 pound per year maleic anhydride plant at Newport, Monmouthshire, England, the largest to be built outside of the United States. The plant is scheduled for completion the latter half of 1960.

Monsanto Chemicals Limited is the largest overseas subsidiary of Monsanto Chemical Company. It operates as a separate entity, and is a major producer of chemicals and plastics for the world market. The new maleic anhydride facility, together with existing facilities will enable the company to supply the future demands of British industry, and also fulfill the consumption requirements of the Commonwealth and other export markets.

•

Water-Soluble Resins

Union Carbide Chemicals Company, division of Union Carbide Corp., has announced the completion of the first commercial unit for the production of Polyox water-soluble resins. The new unit, at the company's South Charleston plant, has a capacity of more than a million pounds per year.

Polyox resins, introduced late in 1957, have been available in development quantities from pilot plant facilities.

Now, three commercial grades of Polyox resins, designated WSR-35, WSR-205, and WSR-301 are available in truckload quantities at sharply reduced prices. The new price schedule is 85 cents per pound in 20,000 pound lots, 95 cents per pound in 150 to 20,000 pound lots, and $1.05 per pound in less than 150 pound lots.

EPOXY ALKYD

(*From page 52*)

in this case 60 hours in a Weatherometer, all three systems (here represented by completely shaded circles and squares) were essentially comparable. Other properties such as adhesion, chemical resistance, yellowing, etc., may vary as the type of fatty acids are changed; however, in terms of stress-strain properties, the film, after a finite period of aging, does not know the fatty acid types are being changed.

Aside from the differences noted above for epoxy modified alkyds, these systems also showed greater hardness, better chemical resistance in terms of solvents, alkalies and detergents and greater resistance to degradation by heat.

In conclusion by a defunctionalization technique, epoxy resins can be adapted to practical alkyd systems to give films characterized by higher tensile strengths than unmodified alkyds of comparable oil length. Further, these epoxy modified alkyds develop optimum stress-strain properties more rapidly than their unmodified counterparts and retain these properties longer under the influence of oven-aging and accelerated weathering. The epoxy modified alkyds also show improved chemical resistance.

References

(1) Somerville, G. R., and Herr, D. S., Ind. & Eng. Chem. *49*, 1078-1082 (1957).
(2) Shell Chemical Corporation, New York.

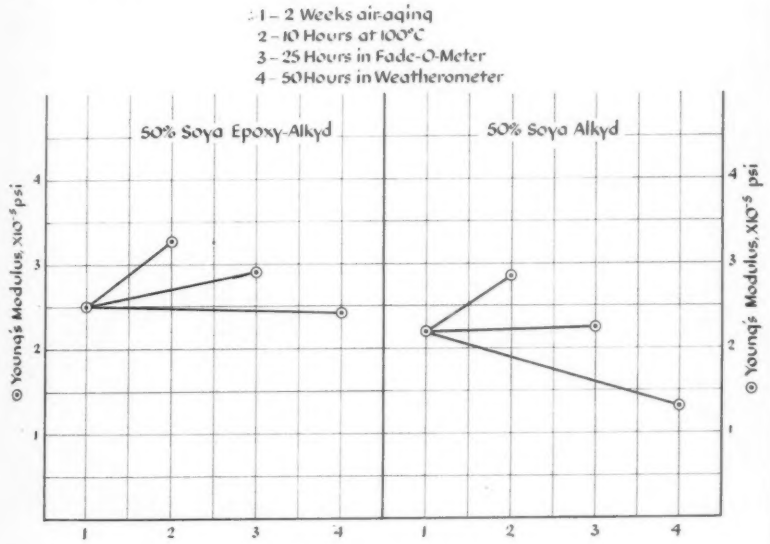

1 – 2 Weeks air-aging
2 – 10 Hours at 100°C
3 – 25 Hours in Fade-O-Meter
4 – 50 Hours in Weatherometer
50% Soya Epoxy-Alkyd
50% Soya Alkyd
◉ Young's Modulus, X10⁻⁵ psi
◉ Young's Modulus, X10⁻⁵ psi

Figure 3. Young's modulus at various exposures.

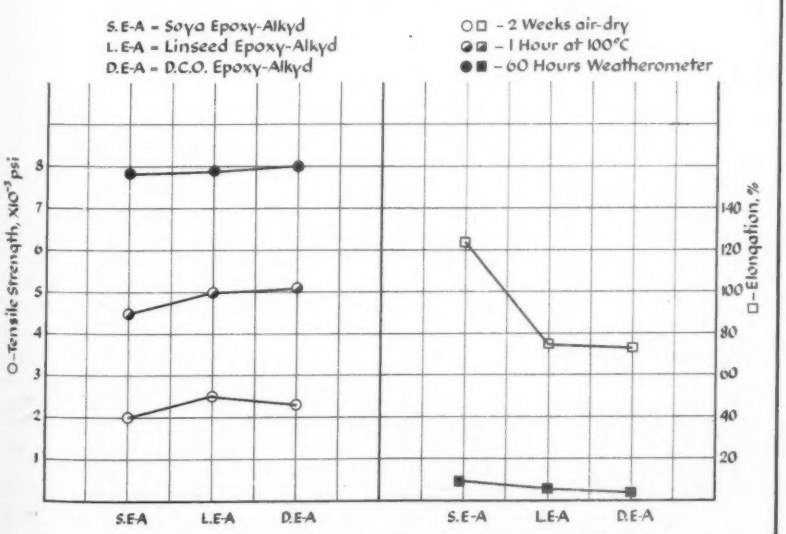


Figure 4. Effect of fatty acid types on epoxy-alkyds.

Mar. 18 20. Annual Meeting of the Southern Paint & Varnish Production Club, Buena Vista Hotel, Biloxi, Miss.
Apr. 5-10. 135th National Meeting of the American Chemical Society, Boston, Mass.
Apr. 23-25. Southwestern Paint Convention of the Dallas and Houston Paint & Varnish Production Club, Shamrock-Hilton Hotel, Houston.

PRODUCTION CLUB MEETING

Baltimore, 2nd Friday, Park Plaza Hotel.
Chicago, 1st Monday, Furniture Mart.
C.D.I.C., 2nd Monday.
Cincinnati — Oct., Dec., Mar., May, Hotel Alms.
Dayton — Nov., Feb., April Suttmilers.
Columbus — Jan., June, Sept., Fort Hayes Hotel.
Cleveland, 3rd Friday, Cleveland Engineering & Scientific Center.
Dallas, 1st Thursday after 2nd Monday, Melrose Hotel.
Detroit, 4th Tuesday, Rackham Building.
Golden Gate, 3rd Monday, Sabella's Restaurant, San Francisco.
Houston, Monday prior 2nd Tuesday, Rams Club.
Kansas City, 2nd Thursday, Pickwick Hotel.
Los Angeles, 2nd Wednesday, Scully's Cafe.
Louisville, 3rd Wednesday, Seelbach Hotel.
Montreal, 1st Wednesday, Queen's Hotel.
New England, 3rd Thursday, University Club, Boston.
New York, 1st Thursday, Brass Rail, 100 Park Ave.
Northwestern, 1st Friday, St. Paul Town and Country Club.
Pacific Northwest, 3rd Thursday, Washington Athletic Club, Seattle, Wash.
Philadelphia, 3rd Wednesday, Philadelphia Rifle Club.
Pittsburgh, 1st Monday, Gateway Plaza, Bldg. 2.
Rocky Mountain, 2nd Monday, Republican Club, Denver, Colo.
St. Louis, 3rd Tuesday, Kings-Way Hotel.
Southern, Annual Meetings Only.
Toronto, 3rd Monday, Oak Room, Union Station.
Western New York, 1st Monday, 40-8 Club, Buffalo.

PERSONNEL CHANGES

ATLAS POWDER

The following changes in the chemicals production department have been announced:

Robert C. Bennett, manager at the aquaness department plant in Houston since 1956, has been named manager of the newly-established international operations section of the production department. Mr. Bennett previously served at the company's Point plant and was manager of the Memphis plant from its opening in 1955 until going to Houston. He joined the firm in 1943 after receiving his bachelor's degree in chemistry from Albright College.

Ralph G. Lightner, production superintendent at the Point plant since 1956, was named manager of the Houston plant, succeeding Mr. Bennett. Mr. Lightner joined the organization as a chemist after receiving his degree in chemical engineering from the University of Virginia in 1943.

Paul G. Briggs, manager of the Memphis plant since 1956 and previously a supervisor there, was appointed to the position of derivatives area production superintendent at the Point plant. Mr. Briggs, who joined the company shortly after receiving his degree in chemical engineering from Pennsylvania State University in 1949, had been supervisor in the company's laboratory pilot plant operations.

Walter R. Guinard, product section supervisor and former supervisor and assistant supervisor, has been named to succeed Mr. Briggs as manager of the Memphis plant. Mr. Guinard joined the firm after receiving his bachelor's degree in chemical engineering from Pennsylvania State University in 1942.

HEYDEN NEWPORT

Robert M. Aude has been appointed vice president and general manager, it has been announced.

R. M. Aude

Mr. Aude began his association with the corporation in 1953 as manager successively, of the Fords and Garfield N. J. plants. In 1956, he was named director of sales planning and coordination. Having more than 20 years experience in chemical industry production and sales activities, Mr. Aude was formerly with Monsanto Chemical Company.

Mr. Aude graduated from the University of Wisconsin with a B. S. degree in chemistry.

GLIDDEN

Dr. William von Fischer was elected vice president, research, and **James W. Pollard** was elected vice president, engineering, it has been announced.

W. von Fischer

J. W. Pollard

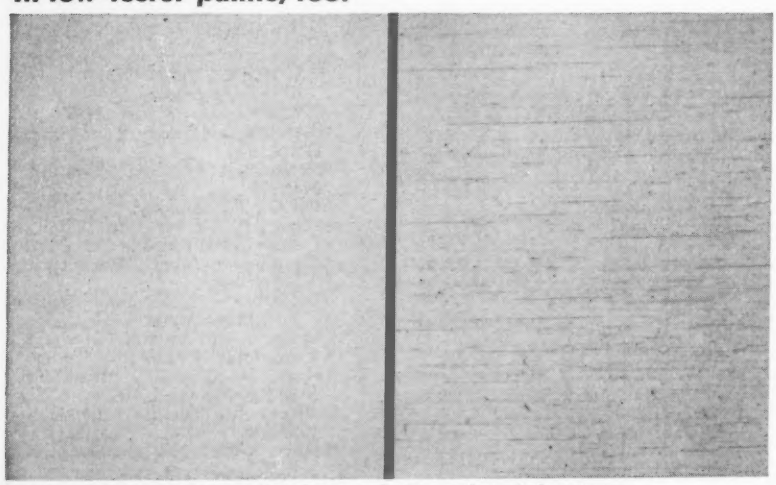
Dr. von Fischer, formerly coordinator of research and development, joined the firm in that capacity in 1956. Prior to that, he had been associated with Case Institute of Technology, Cleveland, in various teaching and administrative positions, including a nine-year term as head of Case's Department of Chemistry and Chemical Engineering.

Dr. von Fischer received his Doctor of Philosophy degree from the University of Minnesota in 1937.

Mr. Pollard joined the firm in 1948 as an assistant superintendent at the firm's lithopone plant in Baltimore. In 1950 he became manager of that facility, and in 1954 was appointed director of manufacturing for the chemicals-pigments-metals division. He was appointed chief engineer of the company in 1956.

Mr. Pollard was graduated in 1940 from the William R. Moore School of Technology in Memphis.

In low-luster paints, too:



Repaints over conventional weathered system. 1 year south vertical exposure—Central U. S. A. Magnification, IX.

ZINC OXIDE MAKES THE DIFFERENCE

If you're concerned about the fitness of low-luster paints for exterior use . . . keep these photos in mind. AZI's recommended formulation (left) and a commercial, zinc-free, low-luster paint (right) were subjected to simultaneous exposure. The correct concentration of zinc oxide kept AZI's paint smooth and tight. The other paint has failed.

Tests like this further verify this fact:
An adequate ZnO content raises the level of performance of outside low-luster formulations . . . just as it improves the service and appearance of any good paint. It provides durability and film integrity . . . resists mildew, staining, and the destructive effects of ultraviolet light . . . imparts superior chalking characteristics.

Mail the coupon below. You'll receive laboratory reports as available on the use of zinc oxide in conventional and low-luster formulations — to assist you in assuring the quality of your exterior paints.

AZI

AMERICAN ZINC INSTITUTE, INC., Dept. B 3
60 East 42nd Street, New York 17, N. Y.

Please send me future laboratory reports and papers on paint formulation findings.

Name_____ Title_____
Company_____
Address_____
City_____ Zone_____ State_____

DEVOE & RAYNOLDS

E. F. Musterman has been designated vice president for trade sales, it has been announced.

E. F. Musterman

Mr. Musterman, with the firm for 24 years, has been vice president in charge of manufacturing and laboratories since 1951, and has served on the company's trade sales new product committee for several years. In his new post he will direct sales activities for consumer paints and related products.

Mr. Musterman joined the firm in 1935 after receiving his Bachelor of Science degree from the Speed Scientific School of the University of Louisville.

Starting in the lacquer department of the industrial finishes plant in Louisville, he was later assigned successively to the company's laboratories there and as a formulator in the automotive finishes laboratory in Detroit. In 1941, he was named superintendent of the industrial finishes plant in Louisville, and in 1948 advanced to general production manager of all plants.

CABOT

Peter Virtue has become a salesman in the New York office, it has been announced.

In this new position, Mr. Virtue will be responsible for sales and sales development of Wollastonite and Cab-O-Sil in New York City, southeastern New York State and southwestern Connecticut.

Mr Virtue joined the company as a co-operative-student laboratory assistant at the Cambridge Research and Development Lab in 1953. After receiving his Bachelor of Science in chemical engineering from Northeastern University in 1956, he became a member of the professional staff at the laboratory. He has been in sales training with the Minerals & Chemicals Division since 1957.

GENERAL ELECTRIC

John T. Castles has been named manager of the chemical development operation, it has been announced.

Formerly manager of sales for the silicone products department at Waterford, N. Y., Mr. Castles received his B. S. degree at Virginia Polytechnic Institute in 1941 and his M. S. degree in Chemical Engineering from Massachusetts Institute of Technology in 1947.

He joined the firm at Waterford as a chemical engineer, immediately after graduation, and subsequently served as manufacturing-engineering manager, plant manager, and manager of technical service.

Appointment of **Dr. George E. McCullough** as polycarbonate manufacturing manager, and **Dr. Leroy S. Moody** as polycarbonate engineering manager, has also been announced.

Dr. McCullough is a graduate of Purdue University. After serving in the army in World War II, he joined the firm in 1948 and since 1956 has been manager of the manufacturing development section.

Dr. Moody graduated from Wesleyan Universtiy and worked as a research chemist on the Manhattan project at the Massachusetts Institute of Technology. He joined the organization in 1945, and for the last two years has been manager of the new product development laboratory of the chemical development department.

SINDAR

Robert L. Williams has been appointed to assume the duties of manager of the Chicago branch office, it has been announced. He has replaced **Dudley F. Lumm,** who has relinquished the duties as a step toward his retirement.

R. L. Williams

Mr. Williams is a graduate of The College of the City of New York, having received the B. S. degree in chemistry and physics. He has been active in both the Cosmetic Industry Buyers and Suppliers Association and the Salesman's Association of the American Chemical Industry, having been a director and chairman of both.

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Sole U. S. Sales Agents for

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ANTIMONY OXIDE
FUNCTIONAL PIGMENTS
Extenders

WHITTAKER

Whittaker, Clark & Daniels, Inc.
100 Church St., New York, N. Y.

SINCLAIR CHEMICALS

John W. Vance has become assistant sales manager in charge of chemical sales with headquarters in New York City, it has been announced.

J. W. Vance

Mr. Vance received his Bachelor's Degree in chemical Engineering from the University of Cincinnati and attended Temple University and Drexel Institute Graduate Schools.

In 1947, Mr. Vance entered the technical service department of Mead Corporation in Philadelphia. From 1948 to 1954, he was employed as a chemical buyer for Rohm & Haas Company, also in Philadelphia. In January 1955, he joined the firm as district sales representative in Philadelphia.

UNION CARBIDE

Bruce A. Gustin, Jr., George S. Cooper, Jr., and **James R. Retter** have been promoted, it has been announced.

Mr. Gustin, formerly district manager for the Boston district, has been promoted to eastern division manager. He has a B. S. degree in chemical engineering from the University of Colorado, and joined the firm in 1939.

Mr. Cooper, who was previously a technical representative, has been promoted to assistant district manager, Delaware Valley district. He has a B. A. degree in chemistry from Colgate University.

Mr. Retter, who was formerly the Albany district manager, has been promoted to district manager of the Boston district. He has a B. S. degree in chemical engineering from the University of Notre Dame, and joined the firm in 1945.

INTERCHEMICAL

Francis A. E. Spitzer has been appointed division president of the international division and **Fred A. Weymouth** has been designated a vice president, it has been announced.

F. A. Weymouth

F. A. E. Spitzer

Mr. Spitzer has been associated with the firm for 20 years. He joined the company in 1939 as a member of its legal department. Named assistant secretary in 1943, he became secretary and head of the legal department in 1945. For the past two years he has served as division vice-president of the international division.

Mr. Spitzer holds two degrees from the University of Paris and the Diploma of the Ecole des Sciences Politiques of Paris and also was graduated from Harvard University Law School.

Formerly division vice-president of the company's printing ink division, Mr. Weymouth has been associated with the company for 29 years.

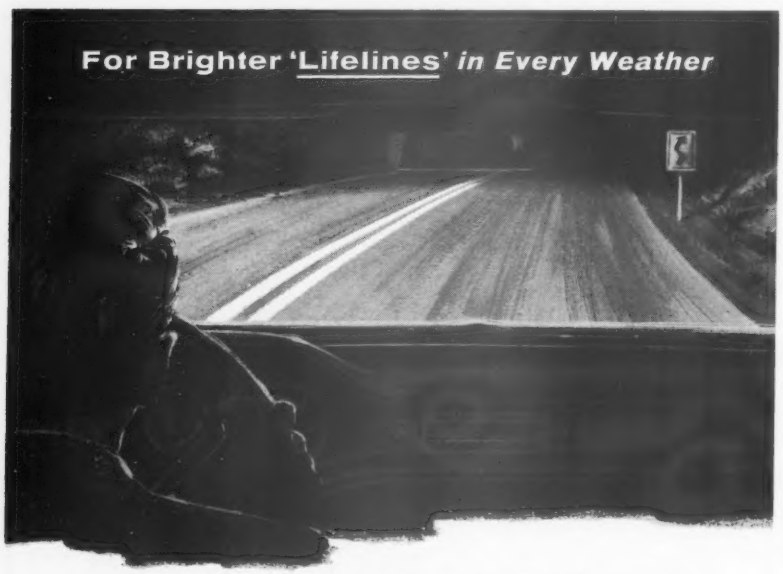
He joined the company in 1929 after his graduation from the University of Cincinnati as a chemical engineer and in 1946 became plant manager of the printing ink division factory in Chicago. He was named a division vice-president in 1950.

DEWEY & ALMY

Glenn D. Jackson III has been named sales representative for organic chemicals for South Carolina, Georgia, and Florida, it has been announced.

Mr. Jackson will sell vinyl acetate polymer and copolymer emulsions; styrene butadiene latices and resins; plasticizers; and dispersing agents—organic chemicals used in the paint, paper, adhesive, textile and plastics industries.

With the firm for a year as assistant to the sales manager, Mr. Jackson received a B. S. in business administration and chemical engineering from the Massachusetts Institute of Technology in 1955.



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UNITED WALLPAPER

Leroy A. Chloupek has been named director of industrial research, **Robert W. Mountsier** has been promoted to technical director of Illinois Paint Works, Chicago, Ill., it has been announced.

L. A. Chloupek

R. W Mountsier

Mr. Chloupek, in his new capacity, will direct the industrial coatings research and development program in the central research laboratories in Chicago and will be responsible for coordinating this activity with the industrial coatings research and development work done throughout the company.

Mr. Chloupek graduated from North Dakota State College in 1933 with a B. S. degree in chemistry, and has been affiliated with the paint industry since that time. He joined the organization in 1952.

Mr. Mountsier is a graduate of Lehigh University, receiving a bachelor's degree in chemical engineering in 1948.

Mr. Mountsier joined Illinois Paint Works in 1951 and until his promotion had served as a chemist in the laboratory and more recently as manager of technical service.

NEW JERSEY ZINC

John S. Collbran, Jr. has been named Pacific district manager, with headquarters in Los Angeles, it has been announced.

Mr. Collbran joined the company in 1945 as a salesman in the Los Angeles office. He was transferred to Chicago in 1949 and became manager of that office in 1954.

James P. Sheridan since 1954 manager pigment sales, western district at Chicago has been appointed western district manager, it has also been announced.

Mr. Sheridan has been in the service of the company for more than 35 years, and for the past 22 years he has been a sales representative in the pigment field.

HOLLAND COLOR

William T. Kays has been named midwest technical sales representative, it has been announced.

Mr. Kays will maintain his office at the D. G. Hereley Company, Chicago. He will coordinate his technical sales and service activities with the Hereley Company which distributes the firm's line of organic pigments in Illinois, and with the J. W. Copps Company in Wisconsin, the G. W. Brandt Company in Minnesota and Kansas and the H. A. Baumstark Company in Missouri.

Mr. Kays was formerly employed in research and sales applications with the pigments division of the American Cyanamid Company. He was graduated in chemistry from Lafayette College, Easton, Pa.

NATIONAL STARCH PRODUCTS

Burton Fink has been appointed sales representative for the resin division in the west coast area it has been announced.

Mr. Fink will handle a complete line of resins for the paint industry as well as its specialty resins for floor polish and adhesives in southern California, Utah, Colorado, New Mexico and Arizona.

Mr. Fink, who has represented the firm in the Atlanta and Miami areas for the past four years, has an extensive background in the utilization of vinyl resins in the protective coating and specialty fields. He will work out of the Los Angeles office.

W. P. FULLER

John M. Fuller has been appointed general manager of the central region, it has been announced.

Mr. Fuller joined the company 12 years ago. He entered the general sales department in San Francisco and shortly afterwards became assistant manager of the industrial finishes division.

He was appointed manager of the Honolulu branch in 1954. He became operations manager of the central region in October 1958, and this month assumed his new duties as general manager of the region succeeding the late **S. H. Kline.**

Mr. Fuller attended Stanford University briefly and then went to Lingnan University in Canton as an exchange student in 1937. Later he attended the American University in Beirut. He holds a master's degree in business administration from Stanford University.

SHELL CHEMICAL

The following personnel changes have been announced:

E. S. Robb, manager of manufacturing; **K. R. Fitzsimmons,** manager of marketing; and **D. L. Yabroff** manager of research and development.

Appointments to positions under these men include: manufacturing—**J. W. Hyde,** operations manager; marketing—**W. Q. Mooney,** sales manager, and **W. A. McCormick,** sales development manager; research and development—**J. B. Henderson,** process development manager and **A. V. Snider,** product development manager.

Mr. Robb, who spent most of his 30 years with the company in the manufacturing phases of the business, was previously manager of head office engineering.

Both Mr. Fitzsimmons, who started with the firm in 1939, and Mr. Yabroff, who joined the company in 1934, began as chemists in the research laboratory. Mr. Fitzsimmons moved into sales in 1947 and served as sales manager of chemical sales division from 1956 to the present. Mr. Yabroff continued in research until 1955. His former position was manager of market development, head office.

AMERICAN CYANAMID

E. K. Hunt has been named to the newly-created post of merchandising manager and **H. C. Milton** has been appointed to succeed him as sales manager of the plastics and resins division, it has been announced.

H. C. Milton

E. K. Hunt

Prior to being named sales manager of the division more than three years ago, Mr. Hunt was public relations manager. During his 15 years with the company, he has also served as advertising manager of the former Calco chemical division, and advertising manager of both organic chemicals and pigments divisions.

Mr. Milton, a verteran of more than 20 years with the firm, has been most recently manager of the process chemicals department. Earlier positions with the company and this division have included manager of its manufacturers chemicals department, eastern regional sales manager, and New England area assistant district manager.

GENERAL ELECTRIC

Armen G. Albarian has been appointed to the sales staff of the west coast section of the chemical materials department headquartered at Anaheim, California, it has been announced.

Mr. Albarian will be reponsible for the sale of polyester resins to the reinforced plastics industry.

Mr. Albarian is a 1948 graduate of Pomona College with a bachelor of arts degree in chemistry. He joined the company in 1948. In 1955, he was named superintendent of the Anaheim plant.

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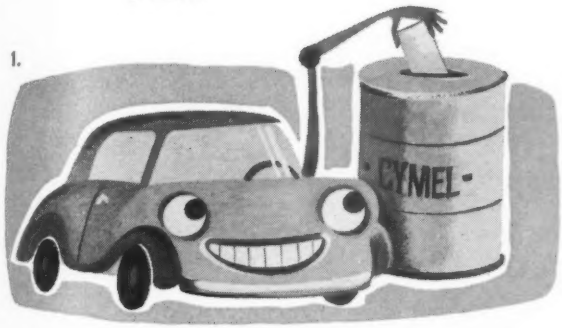
RESIN ROUND TABLE

1.



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2.

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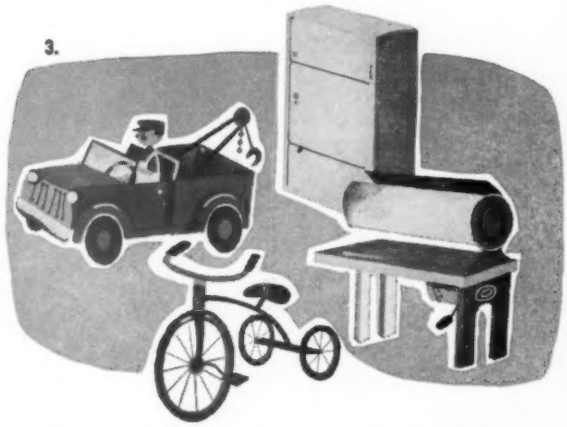
3.



Really fast baking cycles, too – They're in and out of the oven in 10 to 60 minutes at 200° to 350°F, depending on your CYMEL formulation. This can mean as much to the maker of toys as to the maker of the grown-up varieties. And when the heat's on appliance finishes – stove parts, for example, CYMEL resins greatly improve color retention, along with solvent, chemical and mar resistance.

4.

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